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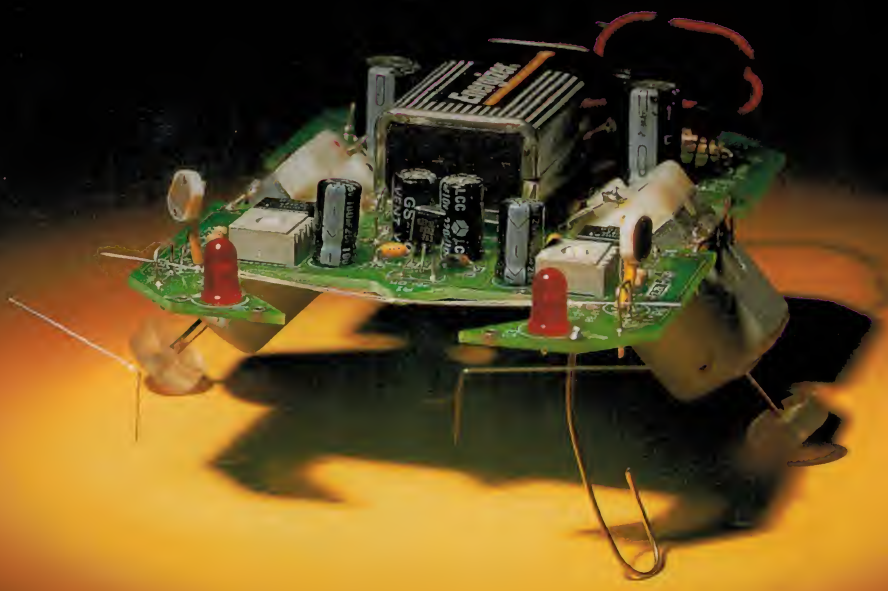

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Once, simply seeing a film was enough.

But now Pioneer home theatre makes it a sensory onslaught.

By making a movie so uncannily real, you'll feel like you're in it.

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World of Electronics

Projects and Technical

Columns and Comments

Departments

On the cover

In the past, making even small robots has involved a lot of skill in making and assembling mechanical parts. That's not so with Craig Maynard's Cybug, though — it's very easy to build. It'll also give you a good insight into current thinking about the behaviour of simple real-world insects. (Photo by Kevin Ling)

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Professional Electronics

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Letters to the Editor

Car electronics

I enjoyed the article by Ross Bannatyne on Moving People Safely, on page 20 of the October issue of EA, and it prompted a few ideas — but also a few comments and pedantic quibbles.

A quibble: In a paragraph in the bottom right corner of page 21, Ross writes *By measuring the rate of change of frequency shift, speed can also be determined*. I think what Ross intended was: "By measuring the frequency shift, speed can be determined, and by measuring the rate of change of frequency shift, acceleration can also be determined". But maybe he didn't. Early in the paragraph, he explains that the sign of the frequency shift gives to or from, and I think he intended to explain that the magnitude gives speed, but became confused. This might be a relatively trivial confusion in terminology, similar to the common but incorrect reference to 'knots per hour' when talking of the speed of a ship; but if Ross is confusing velocity with acceleration, then that is more serious.

Some ideas: I really hope that 'brake by wire' doesn't catch on. Clever electronic gadgets can do so much that it is tempting to think that they can do everything, but sometimes an older technology is more appropriate. In particular, hydraulic systems are well matched to providing the large forces and relatively small movements needed to operate brakes. It might be sensible to use clever electronic circuits to operate the valves that control the hydraulics, but unless there is a huge breakthrough in magnetic materials or conducting materials or both, any electrical gadget capable of operating a brake pad will be big and bulky and complicated and will gobble up lots of power.

I really hope planting magnets every metre or so along the road doesn't catch on, either. I like the idea of making cars self steering, particularly on highways, but I hope it will be done by making better use of information already available, like the lines painted on the road, possibly with better or different paint. I think the technology to achieve this is so close that systems needing magnets would be only a stop gap and a costly distraction.

Ross mentioned cruise controls intelligent enough to match speeds with cars in front, but an extension he didn't mention and that I'd like to see would be a cruise control that adapts to the prevailing speed limit. I think it shouldn't be too hard to do. I can think of three ways it might be done.

The signs already used to advise speed limits could be fitted with a resonator similar to those used to limit shoplifting or similar to those used by some modern building access control systems. Alternatively, they could include a bar code somewhere. Although the codes used in shops would be vulnerable to vandals and dirt, it might be possible to use holographic technology to design a suitably robust and unobtrusive code, or it might be possible to paint the bar code on the road. Probably the best way would be to use GPS technology. If the car knows where it is, it is at least theoretically possible for the electronic maps to include the speed limits as well as the location of the streets and other landmarks.

I wonder if traction control will discourage people of a certain age group from leaving skid marks wherever they have been. I think at least part of the motivation is to demonstrate: "I can afford a car so powerful that it makes skid marks all over the place" — but once traction control becomes a bit more popular, rich kids won't be able to leave skid marks, because they will be driving a car that won't let them, and poor kids won't want to because it will be an admission that "I can only afford a car so dumb that it makes skid marks all over the place".

Keith Anderson, Kingston Tasmania

Bad grammar!

I found your article on sound preservation in the December *EA* very interesting but I was a bit distracted by your use of phrases such as 'what about we amateurs...'. You wouldn't write 'What about we?' would you, and this is a simple test, if in doubt.

Some would say, 'does it really matter?'. I think it does, for the same reason that using non-standard spelling matters (not that I am suggesting that this happens in EA); if the reader spots a mistake their attention is distracted from the intended message to counting the

mistakes and failure of communication results.

I hope you will not be offended by this gentle nudge and I send my best wishes to you and all the contributors to *EA* for the New Year.

John Neate, Blackwood SA

DB connectors

Reading Graham Cattley's review of the WinRadio WR-1500e (*EA* December 1998), I was struck with a glaring mistake which is unfortunately very common in most electronics magazines, not just *Electronics Australia*. Graham mentions that on the back of the WR-1500e is a high density DB9 connector — but there is no such thing!

Almost anybody who has played around with computers knows what a DB25 connector is, but this is only one of a series of 'D' connectors, so called because of their shape. The '25' is because there are 25 pins.

D connectors come in five different sizes. The first four, with their standard pin configurations were for 15 and 25 pins and the less common 37 and 50 pins, with the 9-pin connector a later development. When 15 pins were used in the connector size which normally houses nine pins, then we have a DE connector with 15 pins — which is correctly a DE15, not as commonly called a 'high density DB9'.

Some non-standard connectors are made, generally with less than the standard number of pins, so that it's possible to have a DB9 connector by filling in only nine of the 25 pin positions in a 'B' plug or socket — but which positions are used is the difficult question.

I would like to conclude by thanking the late Morton Williams VK2DEX for teaching me the true designation of these connectors.

Peter O'Connell VK2EMU, Beverly Hills NSW.

❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

Editorial Viewpoint

The *positive* case for DVD video: superb images and sound!

I DARESAY THAT with respect to DVD video, I must have seemed a bit of a jeremiah over the last 12 months or so, warning here and elsewhere in the magazine about the risk of DVD being stillborn in this area of the world. And I make no apologies for what I've written, because I still believe strongly that DVD could easily go the way of Laserdiscs and other 'also ran' consumer technologies — in this case largely because the software producers have seriously hobbled it (especially for Australia and New Zealand) with that restrictive regional coding and the almost inevitably slow trickle of DVD movie releases.

All the same, I'd like to take the opportunity here to correct any possible negative impression I may have given you about *DVD video itself*, as a medium for home entertainment. That's because there's no doubt in my mind that for watching movies in the home, this technology really is a quantum leap forward.

One page 10 of this issue, you'll find a glowing review by Louis Challis of the new Kenwood DVF-5010M DVD player. After Louis had finished testing this player and trying it out, I was able to borrow it myself over the Christmas break. This gave me an excellent opportunity to watch a few DVD movies in 'relaxed mode' — complete with digital surround sound, as the DVF-5010M has a built-in Dolby Digital (AC-3) decoder.

It was all *very* impressive. However I didn't quite realise just *how* good it was until a few nights later, when I found myself watching the movie *Titanic* again, in a similar situation but from VHS tape. Suddenly it hit me just how much clearer, sharper and more stable the picture is, from a modern 'third generation' DVD player — and how much quieter, cleaner and more faithful the sound.

It's true that with the first sample DVD players we saw, a couple of years ago, neither the pictures nor the sound seemed all that wonderful. Both seemed to have perceptible 'glitches' due to the digital compression technology, and the players seemed to be highly susceptible to dust and scratches on the discs. However it's now clear that virtually all of these problems have been well and truly overcome, and that DVD video is now a fully stabilised and market-ready consumer technology. The image resolution and stability are at least *double* those of VHS tape, while the sound quality from those 5.1-channel Dolby Digital tracks is so close to 'linear' CD quality that it's now virtually impossible to tell the difference.

Frankly, you now only have to watch a few movies on DVD, in a modest 'home theatre' setup, to be spoiled forever as far as VHS tape is concerned. Your subjective standards and expectations are simply raised to a new level...

So let's be completely clear about DVD video. There's nothing at all wrong with it as a medium for home viewing of movies; in fact technically, it's superb. The only thing likely to prevent it becoming the dominant home movie medium for the future, here in 'Region 4', is the pathetically small range of movie titles we've seen released on DVD as yet. And that's entirely in the hands of the software industry...

Jim Rowe

PS: If the software people *do* see the light and release enough movies on Region 4 DVDs to let the technology 'take off' here, I suspect this will also result in a market boom for large-screen TVs — because the picture quality is so good, many of us will finally want to upgrade to bigger sets, to take full advantage of it.

WHAT'S new
in the ever-changing world of electronics

Fast printers for digital photos

Mitsubishi Electric has announced two new enhanced dye-sublimation Digital Photo Printers, employing new technology and a fast SCSI interface for high speed printing. The new CP Series printers are expected to attract considerable interest in both the semi-professional and professional imaging markets.

The new CP800DW and CP7000DSW printers support postcard and panorama sizes and feature four-pass media that adds a protective laminate to prevent image fading. Both printers use New Roll Technology for volume production, with the larger capacity CP7000 printing up to 600 prints per roll on standard media.

Other features include a 244dpi thermal head, SCSI and Centronics interfaces on the CP800 (SCSI interface on the CP7000) and Windows 95 and Macintosh drivers with a Photoshop plug-in.

For more information circle **143** on the reader service card or contact Mitsubishi Electric, 348 Victoria Road, Rydalmere 2116.

CD players are HDCD compatible

US manufacturer Harman Kardon has upgraded its hardware line-up and is introducing a new range of single- and multidisc CD players to the Australian market. The new players have features and benefits ranging from basic CD player functions to HDCD (High Definition Compatible Digital) capability.

There are three new single-play and two new multidisc carousel players. All three single-play models (HD720, HD740 and HD760) feature a new generation three-beam laser pickup for stability and precise focus; and 8-times oversampling with a high grade digital filter to minimise distortion. Each model also uses a Burr-Brown digital to analog converter. The top-of-the-range HD760 also features four individual power supplies and is HDCD-equipped.

The two multidisc models (FL8350 and FL8550) combine high performance with elegant design, and the lineup includes the first affordable multidisc CD changer with HDCD decoding. Both players feature a specially designed power supply, five-disc capacity with play exchange and extensive programming features. The digital-to-analog conversion for the FL8350 is provided by dual 16-bit linear DACs, while the FL8550 features both HDCD processing and dual 20-bit Burr-Brown 1702 DACs.

The HD720, HD740 and FL8350 have RRPs of $599, $799 and $599 respectively, while the HD760 and FL8550 have RRPs of $1299 and $799. For more information circle **141** on the reader service card or contact Convoy International, 1801 Botany Road, Botany 2019.

Handheld PC has good connectivity

Sharp's new PV-5000A handheld PC can be used to access all the programs on your full-size PC, send and receive faxes, connect into the office network and synchronise all your data. Inside its lightweight (1.4kg) and compact (259 x 212 x 21.2mm, folded) case it packs in Microsoft's powerful Windows CE Handheld PC Professional Edition operating system, 32MB of memory, a 4096-colour 8.2" touchscreen VCA LCD screen with stylus pen, a large keyboard and an eight hour rechargeable Lithium-Ion battery.

The new notebook is loaded with software to keep you in touch and ahead of the speed of business. The Windows CE Professional Edition offers Pocket Applications of Word, Excel, PowerPoint, Outlook, Internet Explorer and Access, as well as the e-mail software Inbox.

The PC also includes all necessary ports to communicate: USB, a high-speed 4Mb/s IrDA infrared port, serial, printer, mouse/keyboard ports and an external floppy disk drive — plus the ability to drive an external VGA monitor.

RRP for the PV-5000A is $3995. For more information call Sharp's consumer hotline on 1300 304 075.

Pocketable unit offers talking books, spoken news

US firm Audible.com has just released its new MobilePlayer-PLUS, a 100-gram device which stores over seven hours of spoken audio in compressed digital form, downloaded from the company's web site via a standard PC and browser. The company is offering audio subscriptions to business publications such as *The Wall Street Journal*, audio versions of best-selling books by authors such as Stephen King and Robert Ludlum, audio versions of popular magazines and more — some 15,000 hours of material, currently.

The solid state memory inside the player is sufficient to store two abridged audio books plus news material, or a single unabridged novel. It's currently selling in the USA for $299.

New speakers from JBL

JBL has introduced a new loudspeaker range, the Ti-100 Series, now available at JBL retailers nationwide. Initially consisting of two models, the Ti-200 bookshelf and the Ti-600 floorstanding model, the range is hoped to lead JBL into the next millenium, with additional models planned for a mid-1999 release.

The Ti-600 three-way floorstander model has an RRP of $1999/pair and houses dual 165mm woofers in two independent and individually tuned low-frequency enclosures, which inherently reduce standing waves. The 115mm midrange is housed in its own chamber. The Ti-600 shares a new innovative 25mm Titanium tweeter with the Ti-200 bookshelf model.

Computer designed and modelled, the craftsman-built MDF cabinets include heavy-duty bracing to reduce internal standing waves. The cabinets are finished to a very high standard with hand-selected veneers in an eye-catching Natural Beech or Black Ash colour.

The dome in the new 25mm titanium tweeter uses a new nitrogen evaporation process, which allows the formation of a stress-free dome just 25 microns thin (thinner than a single human hair). In addition, the new 165mm advanced driver has a chassis of mineral-loaded polypropylene that eliminates resonance and ringing. In addition, since the chassis is non-magnetic, the energy of the powerful magnets is precisely focused at the voice coil.

At 410 x 210 x 312mm (HxWxD) and 9.0kg, the Ti-200 bookshelf model fits neatly into virtually any decor. The RRP is $1299/pair. For more information, circle **149** on the reader service card or contact Convoy International, 1801 Botany Road, Botany 2019.

Cyber-age entertainment centre

Advanced Energy Australia (AEA) has claimed a world first with its Cybernet PC TV, which it says heralds a new age of home entertainment in Australia. The Cybernet PC TV combines a high-resolution television with a powerful computer, a Digital Video Disc (DVD) player, a Compact Disc (CD) player and a communication centre for faxing and fast connection to the Internet.

Introduced by AEA division Cybernet Entertainment, the new product is said to bring all of the latest home entertainment technologies together in one product that will show movies, play music, surf the Internet, tune into normal or pay TV with a state-of-the-art high resolution picture or become a lifesize computer monitor for games or serious computing. It comprises three components — a high resolution colour monitor in a choice of three sizes (51, 68 or 80cm — 68cm currently available); an advanced DVD/PC unit packed with the latest sound, vision and computing hardware; and a novel cordless keyboard with single-touch short-cut keys for immediate connection to the Internet, movies, DVD, CD and volume control.

There are connections for a printer, scanner, digital camera, joystick and mouse.

The Cybernet PC TV also supports Dolby Digital (AC-3) sound, to provide full home theatre surround sound when linked with a compatible 5.1-channel hifi system. In addition to playing DVD movie titles, the DVD section will also play your CDs and DVD audio discs.

The inbuilt PC is based on a Cyrix chip with 64MB of SDRAM (expandable to 128MB), a 4.3GB hard drive, 2X speed DVD-ROM drive and MPEG2/Dolby Digital (AC-3) decoder board, and is preloaded with Windows 98. It also features a fast 56k modem for easy Internet access, a 3.5" drive and 16-bit sound card and has a full array of connection ports: a parallel port, two USB ports, a serial port, a monitor port and a game port.

When configured with the 68cm colour screen, the Cybernet PC TV has an RRP of $5495; pricing on the smaller 51cm and larger 80cm screen configuration are yet to be announced.

For more information circle **140** on the reader service card or contact Cybernet Entertainment on 1800 626 858.

WHAT'S new in the ever-changing world of electronics

Ultra-compact digital camera has 3X zoom

The new Olympus Camedia C-900 Zoom digital camera is claimed to redefine how a compact digital camera should look and handle. Designed with the same styling and features as the company's very successful Mju Series of 35mm compact cameras (more than 10 million units sold), the new C-900 Zoom has already become the best-selling digital camera in Japan since its launch there in late October.

The megapixel C-900 Zoom features a top grade glass 3X optical zoom lens covering the equivalent of 35-105mm, plus a host of features, packed into an elegant and ultra compact body. These include a CCD sensor with 1.3 million square pixels (1280 x 960 images); a 4.5cm LCD screen and optical viewfinder; and a Digital ESP metering system, delivering precise exposures.

The C-900 Zoom is supplied with a 4MB SmartMedia card with Panorama function, case, connection kit for Windows (98/95/NT4.0/3.1) and Macintosh, Camedia utility software, PhotoAlbum organiser software, PhotoShop plug-in for Mac, and TWAIN driver for PC. It has an RRP of $1699.

For more information circle **142** on the reader service card, contact your nearest Olympus dealer or distributor R. Gunz (Photographic), Locked Bag 690, Beaconsfield 2014.

Flat panel speakers

Speaker maker Kwong Quest LLC has created quite a stir by releasing its new Benwin Flat Panel BW2000 speakers in the USA. Based on research by British Aerospace on flat panel audio technology, the speakers have no cone driver but instead employ rigid panels that are excited in complex resonant modes, to produce even radiation from the full panel area.

Measuring only 125 x 175mm, the panels speakers are very thin but are claimed to cover the frequency range from 60Hz to 18kHz. The BW2000 system also includes a compact woofer to enhance the bass, and is suitable for both compact music systems and multimedia computer use. It's selling in the USA for only $129.

50" plasma display has XGA resolution

Pioneer says its new PDP-501MX Plasma Display Panel has revolutionised plasma display viewing, by providing true XGA resolution — reproducing bright, full-colour data and images from a wide range of sources including computer-generated text and graphics.

The screen is 50" wide (1270mm) and less than 100mm deep, with a weight of less than 43kg. This means it can be mounted just about anywhere. Thanks to the XGA resolution (1024 x 768 pixels), image definition is more than 2.5 times that of VGA panels. Coupled with the high image brightness of plasma technology, this gives images with great impact.

The PDP-501MX is compatible with an extensive range of input formats including VGA, XGA and SXGA. It can display everything from computer generated text and graphics to CAD design and even terrestrial and digital television DTV broadcasts.

Other features include an RS-232C port for external control, a Colour Mode Switch (adjustable white balance for re-shooting) and Key Lock to prevent accidental switching of system settings.

For more information circle **145** on the reader service card or contact Pioneer Electronics Australia, 178-184 Boundary Road, Braeside 3195.

80cm CTV from Philips

Bigger is generally better when it comes to watching TV. With sets like Philips' new Powervision 80cm model, the screen is flatter, the sound is fuller and the innovative Mega PIP (picture in picture) feature means you won't miss a thing.

Known as the Powervision 34PT5693, the new set has been launched in response to a growing demand for good quality, large screen TVs. The flat screen ensures everyone in the room can see a superb picture easily. Features such as Skin Tone Correction and Contrast Plus deliver more realistic and natural images, with greater richness and detail.

The two-tuner Mega PIP feature means you can watch one TV station or video recording on the full screen while a smaller screen shows the broadcast from another channel. This feature is much appreciated by people who watch long sporting programs, for example, but want to be glued to a movie at the same time!

Three sound features — Auto Volume Leveller, Incredible Stereo and SMART Sound Control — combine to boost sound performance and give the impression that sound is 'surrounding' the room without the need for additional speakers.

The Philips Powervision 34PT5693 has an RRP of $2999. For more information contact your nearest Philips Sound and Vision dealer.

Light-valve projector delivers 2000 lumens

Barco Projection Systems has added another member to its family of digital light-valve projectors: the BarcoData 3300. Based on the proven concept of the BarcoData 3200 with a new 700W metal-halide lamp, the new unit produces an extremely high light output of 2000 lumens.

The 3300 has three 3.2" active matrix LCD panels with a resolution of 800 x 600 and a built-in Pixel Map Processor, which enable the unit to display all sources from VHS Video up to 1280 x 1024 pixel workstations. Like the BarcoReality Series projectors, it completes the digital video chain with a Serial Digital Input using the 4:2:2 standard, resulting in unsurpassed digital video quality. In addition, it is equipped with True Colour Reproduction (TCR) for excellent colour display and uniformity over the entire screen, as well as optimum colour tracking and gamma correction.

For more information circle **146** on the reader service card or contact Barco Systems, Unit 6, 11 Lord Street, Botany 2019.

System incorporates upgraded classics

For many hifi buffs and those who appreciate fine music, Bose 901 speakers have represented the height of luxurious sound excellence from the time the original speaker system was released in 1968. An excellent wine often matures by simply being left alone, but Bose says its 901s have undergone over 1000 advances in the last 30 years, to retain their position as top-performing speakers.

Now, though, to celebrate the 30th anniversary of the 901s, Bose has combined the enhanced speakers with the advantages of a fully integrated music system to produce what they claim is the 'ultimate lifestyle experience': the Bose Lifestyle 901. The Direct/Reflecting speaker technology featured in the Lifestyle 901 recreates live music qualities by emanating sound directly towards the listener, plus bouncing sound from the room's walls, floors and ceilings.

Bose has designed the system so that approximately 11% of the sound is actually directed to the listener, with the other 89% enveloping them from all directions. Eight full-range drivers in the back of the speakers reflect sound off the walls, with one full-range driver directing sound towards the listener.

The Lifestyle 901 system incorporates active equalization to achieve a natural balance of bass, mid-range and treble frequencies. It smooths out the typical bumps and dips in frequency response that are the result of any speaker's driver sensitivity, enclosure characteristics, speaker placement and grille effects.

The sleek, brushed aluminium music centre of the Lifestyle 901 eliminates the need for large bulky component systems. The small laptop computer sized unit incorporates the tuner and the world's smallest six-stack CD changer system. It also has inputs for TV and video audio; two zone capabilities, where you can add an additional set of speakers for another room; and an easy to operate, RF remote control which can work through floors, walls and ceilings.

The Bose Lifestyle 901 carries an RRP of $9999. For more information circle **147** on the reader service card or contact Bose at 1 Sorrell Street, Parramatta 2150, or on 1800 023 367.

Kenwood's DVF-5010M DVD Player with DTS

This month, our review Louis Challis has been testing and trying out the DVF-5010M, one of Kenwood's new third-generation DVD players. This player is of particular interest because it includes a built-in Dolby Digital (formerly AC-3) surround sound decoder, and is also able to recognise digital sound tracks encoded with the DTS compression system.

KENWOOD'S ENTRY into the DVD market may have been slightly behind that of some of its competitors, but the wait was obviously worth it. This is a third-generation DVD player that has certainly whetted *my* appetite, and I suspect may well whet yours too.

The DVF-5010M displays a number of unusual and exciting attributes. It also embodies a number of outstanding features that most of its competitors' DVD players currently lack.

This is a particularly natty DVD player. The designer's choice of a sharply-curved brushed satin aluminium front panel is decidedly more attractive than the Henry Ford 'black is beautiful' concept that the bulk of its competitors are currently following. I've got the feeling that black is now becoming passé, and consequently I was immediately attracted to this warmer, friendlier appearance. More importantly, the black lettering and symbols on a bright silver facia made them far more visible and readable.

The large black central display panel tends to be daunting, until you turn on the power and you are greeted by the word 'READING', followed by the words 'NO DISC'. Uh oh! If I want it to play I'll obviously have to insert a disc onto its tray, which smoothly pops out at the touch of a button.

The front panel controls are sparse, but adequate for simple and straightforward playing of CDs or DVDs. The controls are limited to an elongated panel open/close button, a large stop button, a large play button and four somewhat smaller elongated buttons (or keys) for repeat, pause, and skip down or skip up one track. Two smaller circular buttons (or keys) labelled with double arrows provide manual search up and down.

The display panel indicates DVD, VCD, CD, Dolby Digital, PCM Angle, Random Repeat, Program, Left and Right Stereo, Play, Pause, Title, Chapter, Track, CD and Text. The word 'TEXT' caught my eye as this is the first CD/DVD player I have seen which offers the option of reading textual information with which many, if not most, future CDs will be encoded. When suitably encoded, you will be able to scan through the tracks of the CD to find the track you wish to play.

> ***"Whoopee! With the DVF-5010M's decoding capability, supplemented by the amplifiers and speakers I already own, I had a latent 5.1-channel Dolby Digital sound amplification system"***

Do *I* have such a CD? Well, no, I don't! However, by the time you read this review I have no doubt I will have a few, with which to test the next generation of CD and DVD players.

The DVF-5010M incorporates some other equally natty features. The first and potentially the most important of those are to be found on its back panel. Yes, it contains the standard coaxial and optical digital outputs, plus S-Video, normal video and left and right channel mixed line outputs. However, it also provides coaxial sockets for the full complement of 5.1 (6) directly decoded audio output channels, for either Dolby Digital or the preferred six-channel PCM output.

Now as it happens, I — like the majority of readers, I'm sure — don't currently own a Dolby Digital decoder. Whilst I have at least a dozen mono and stereo amplifiers available from which to choose, and an even larger number of loudspeakers, they offered me no real advantage in the absence of an AC-3 decoder.

Whoopee! With the DVF-5010M's decoding capability, supplemented by the amplifiers and speakers I already own, I had a latent 5.1-channel Dolby Digital sound amplification system, just waiting for interconnection of the amplifiers and speakers. This is a situation in which many readers will already find themselves, having purchased many of the more critical elements with which to assemble their own full-blown home theatre system.

It doesn't take much to realise that's precisely what I did in my living room. The subsequent level alignment exercise was considerably simplified as a result of the functional convenience of the GUI (Graphical User Interface), which is an integral feature of this DVD player. It offers a simple, smooth and virtually foolproof system of level alignment, provided you follow the handbook's instructions.

It would be unfair of me if I didn't admit that I used Joe Kane's latest DVD test disc *Video Essentials* to simplify the individual channel level adjustments, with a small hand-held sound level meter. Whilst the task could be roughly performed by making the adjustments by ear, even an inexpensive Tandy sound level meter would prove to be more than adequate to fulfil this otherwise tricky task.

I discovered that the DVF-5010M's GUI offers you the opportunity to individually adjust the time delays between the rear and front channels, and then stores the settings, negating the need for future tiresome

Unlike most of the current generation of DVD players, Kenwood's DVF-5010M has a stylish 'brushed aluminium' satin finish.

realignments. I was able to align each of the speakers in terms of level and appropriate time delay to achieve what I regarded as being a commendable system, in less than half-an-hour.

Remote crucial

To be able to gain access to the full range of the DVD player's features and facilities, you are forced to use its remote control unit. As small and as handy as that remote control may be, I quickly discovered that appropriate familiarisation with the location of each of the buttons is essential if you don't wish to waste time searching for them. That, of course, is where the DVD player's handbook comes into its own.

This particular handbook is one of the best prepared and most comprehensive I have seen. Not only does it define the region codes for which the DVD player is encoded, but it shows graphically the regions of the world in which those codes are intended to be used. (I haven't seen this elsewhere.)

Before progressing further, I decided that I must look inside the case to find out what makes this unit tick. With the cover removed I found five separate major modules. The first module is the central DVD player. The construction of this unit is not as solid as in the more expensive DVF-K7010 or the top of the line DVF-9010, which are considerably more expensive than this player. The more expensive models incorporate more metal and more innovation decoupling and vibration isolation elements.

Whilst I suspect that the more expensive modules provide marginally better performance, common logic has it that, if the cheapest module provides adequate, or more specifically more-than-adequate performance, then you'd have to have some compelling reasons to spend the extra money.

On examining the video demodulator card's printed circuit I observed some of the finest, closest and thinnest printed circuit tracks I have yet seen. The card sports six prominent LSI circuits from major suppliers, supplemented by other smaller chips.

The large audio demodulator decoder board is located at the rear of the cabinet. This board is significantly smaller than all of the first- and second-generation DVD players that I have previously examined. It also incorporates a large number of LSI chips, including Kenwood proprietary chips. This board has been very cleverly designed to simplify external connections and so as to reduce problems of unwanted internal spurious signal degradation.

The power supply is innovative in that it is designed to operate on any voltage from 110 to 240 volts, with either 50 or 60Hz input frequency. This is a real advantage if you are thinking of moving from one country to another, and wish to take your discs and player with you. The power supply is well protected from external transients and has been well screened from the rest of the electronics in the cabinet.

The cabinet, the components, the ribbon cable wiring harnesses and overall layout are impressive. Notwithstanding, I would dread the thought of having to change anything but the simplest of components. I suspect that, when faced with a major problem, the repair process would frequently involve a classic case of 'repair by replacement'.

On test

The objective testing of the DVF-5010M proved to be both simple and straightforward. It quickly convinced me that this is an unusually good CD player.

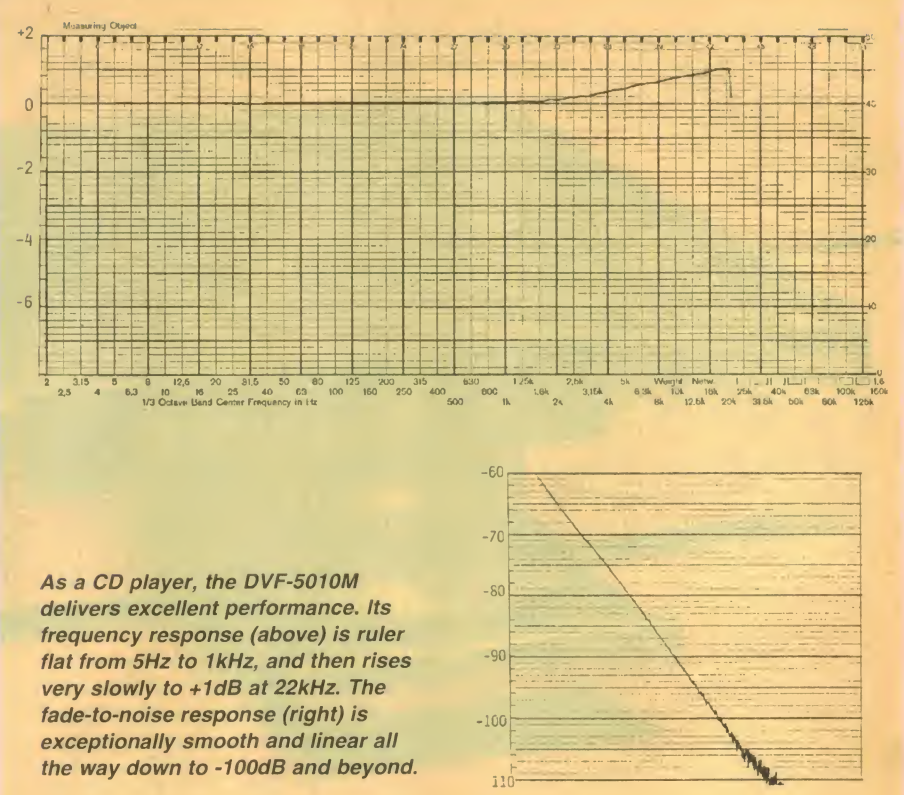
By way of explanation, I have formed the view that most DVD players will spend more of their time being used as CD players than they will in the stated role of DVD player. Now as it happens, when you conduct a series of objective tests on a CD player you rapidly find out whether you're assessing either a good piece of equipment or, what is less frequently observed, an outstanding item of equipment.

The first objective test of the CD player's replay frequency response revealed that its

output is within +1dB/-0dB from 5Hz to 22kHz. The characteristic shape of the curve is very similar to each of the other second-generation DVD players that I have recently tested. The replay response exhibits a gentle rise of 1dB over the range 1kHz to 22kHz. However, the frequency response is ruler flat between 5Hz and 1kHz.

Overall the replay linearity is exceptionally good. The maximum deviation between specified recorded level on my test discs and the measured replay level was -0.3dB at -90dB. Even a glance at the 'fade-to-noise' test reveals an exceptionally smooth response all the way down to -100dB. The linearity is still commendable and more than acceptable between the -100dB and the -110dB level, which is a dynamic range well beyond what the above-average audiophile would ever hear or detect.

Using my special Sony/CBS black stripe test disc I confirmed that the player will happily track discs with interruption in information (black stripes) with widths of up to 3000 microns (3mm), before exhibiting any signs of unwanted audible artefacts. The measured signal to noise ratio was 111dB, and the dynamic range was a very effective 98dB.



As a CD player, the DVF-5010M delivers excellent performance. Its frequency response (above) is ruler flat from 5Hz to 1kHz, and then rises very slowly to +1dB at 22kHz. The fade-to-noise response (right) is exceptionally smooth and linear all the way down to -100dB and beyond.

Subjective tests

To begin my subjective evaluation I used two new CDs, which proved to be outstanding in their recording characteristics, in order to compare the performance of the DVF-5010M against my existing tried-and-true CD player.

The first disc features the guitarist John Williams in a disc whose program content was only recorded in March 1998. This recording (The Guitarist John Williams, Sony Classic SK60586) is without a doubt one of the best that John Williams has yet produced, and would have to be one of the most outstanding and rewarding discs I have auditioned during the past year. During the replay, the DVF-5010M literally shined. Whilst the audible differences were neither marked nor dramatic, there could be no denying that the DVF-5010M provided a remarkably smooth and superior replay performance when compared with my existing CD player.

The second disc I used features one of my favourite pianists, George Shearing in 'Christmas with the George Shearing Quintet' (Telarc 83438) with 15 Christmas tunes presented with a degree of panache that only George Shearing can achieve. Whist Christmas tunes may not be your favourite music, George has the ability to convert seasonal music into acceptable everyday music.

My verdict so far: when used as a CD player, the DVF-5010M is hard to beat.

Kenwood provided me with a DTS encoded demonstration DVD disc, entitled Demonstration DVD No.3 (Digital Theatre System), with which to evaluate the DVF-5010M's processing capabilities. Having previously heard a DTS system in the IMAX theatre at Katoomba, I already know that DTS can provide exciting audio to supplement quality video.

Now as good as the demonstration disc may be, one must face the facts. To my knowledge there are currently no commercial DTS Region 4 discs available, and it would appear unlikely that there will be in the immediate future. All of which means that by incorporating this DTS replay feature, Kenwood has delayed the premature obsolescence of this DVD player.

Obviously, when most people purchase a DVD player, its visual performance and of course its multi-channel audio performance are the critical parameters for which you seek the best possible results. As hard as I tried, I was unable to obtain any new DVDs

Revealing the inbuilt Dolby Digital decoder, there are six decoded surround sound outputs as well as mixed-down stereo audio outputs — plus composite and S-video outputs, and both bitstream and optical digital outputs.

to play. I had to be satisfied with replaying some DVDs that I had previously viewed and reviewed.

The two discs that I ended up using were firstly, *In the Line of Fire* (Columbia Tristar 52315C), which provides enough 5.1 channel information to satisfy my quest of acoustical envelopment with a matching degree of visual excitement. I know some people become tired of Clint Eastwood's penchant to fire a big gun, however I guess I haven't seen so many of his films to be desensitised. I enjoyed the DVD and the quality of the picture was exceptionally good.

At that stage I loaded a far more entertaining and uplifting DVD, with Jim Carey in *The Mask* (Roadshow Entertainment 174039) and although it only provided two channels of audio, the visual impact and excitement it created was outstanding.

Summarising...

Although the Kenwood DVF-5010M DVD player is the least expensive in Kenwood's three-model DVD player lineup, you should neither be fooled nor confused by its ranking. This appears to be a true third-generation DVD player, with loads of user-friendly functions that I haven't described and a performance level which certainly equals, and in most respects outranks, any previous DVD player that I have yet tested.

The DVF-5010M is both an outstanding CD player and a superlative DVD player. It incorporates more inbuilt attributes and features than any other DVD player I have yet reviewed. The features I like best are its sensible ergonomic design, its attractive appearance and a level of technical performance that belies its price or perceived position in the marketplace. In fact I was unable to identify any features that I didn't like. ❖

Kenwood DVF-5010M DVD and CD player

A third-generation DVD/CD player with inbuilt Dolby Digital decoder. Measures 440 x 390 x 93mm, weighs 4.5kg. Unit tested S/N 80801517.

Good points: *Impressive styling, easy to set up and use. Inbuilt Dolby Digital decoder makes it easy to experience the full impact of 5.1-channel surround sound. Excellent performance playing both DVDs and CDs.*

Bad points: *Nothing significant...*

RRP: *$1599.*

Available: *Kenwood audio-video dealers, or contact Kenwood Electronics Australia, 8 Figtree Drive, Homebush 2140; phone (02) 9746 1888.*

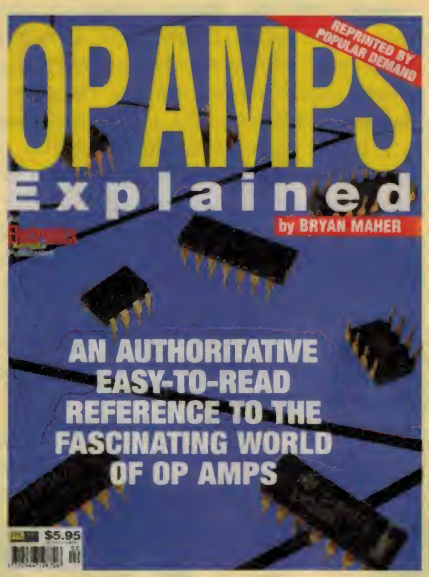
Two new publications available from Electronics Australia

Basic Electronics

AT LAST there's a new and easy to read introduction to modern electronics for students and hobbyists. The author is well known technical writer Peter Phillips, a former technical college teacher who has produced many award-winning electronics textbooks and is also a regular contributor to Electronics Australia.

Peter's new book is written in an easy to read style, and includes not just theory but also a collection of simple construction projects, to give valuable 'hands-on' learning.

The book is designed to give you a good grounding in all of the basics of modern technology, with the 20 chapters covering everything from resistors to thyristors, batteries to power supplies and diodes to opto-electronics.



Op amps Explained

LOOK INSIDE almost any piece of modern electronic equipment (even things that are normally 'digital'), and you are likely to find op-amps amplifying, shaping, clipping, detecting level changes or otherwise processing signals.

Without op-amps, we'd still be stuck in the electronic dark ages, and without a basic understanding of the way they work, and the way they're used, you probably won't get very far in today's world of electronics.

This book can be your guide and reference: it is authoritative, but at the same time very accessible - and it gets right down to the very concepts of op-amp operation to make them understandable as well.

We recommend it to everyone interested in analog electronics, operational amplifiers, and their applications, whether at a hobby level or as a serious University or College student. These are both on sale at your nearest newsagent, or you can order them directly from us here from our Reader Services Department for $6.95 each (includes P+P).

To order your copy of Basic Electronics or Op amps Explained, contact our Reader Services Department via email, or by mail or fax.

Photos on Floppies...

Sony's latest digital still cameras can store your images on floppy disk — making it very easy to transfer them into a PC. Some models will even shoot a short video clip, and store it in the same way for use on your Web site. On the other hand, their new TRV-900E Digital Video camera offers the ability to save still images, on floppy or Memory Stick. What *will* they think of next?

by Barrie Smith

DIGITAL IMAGE capture technology is currently in a state of flux; a number of video camcorders have recently offered enhanced modes of still capture, with resolution levels only limited by that of the video signal itself. Conversely, a few digital still cameras have now slipped into movies.

For example Sanyo's VPC-G250EX can shoot digital stills — and capture a few seconds of video and sound up to 320 x 240 pixels (quarter of an average PC screen) in dimension, and store it on a SmartMedia card. Standard resolution is 320 x 240 pixels in a 10 frame/second movie clip; economy resolution gives a 320 x 120 pixel movie at a screen rate of 15 frames/second. Video clip mode captures a total of 15 frames at 0.1 or 0.2 second intervals; in other words the clip, when shown on TV will last either 1.5 or 3 seconds; sound is also captured. Clips are stored in Motion JPEG AVI format, and all for a price of $1299.

Soon after the Sanyo arrived, market leader Sony pulled an extremely attractive rabbit out of its corporate hat by updating its popular Digital Mavica cameras. Image resolution was lifted to 1024 x 768 pixels, and as a bonus they offered the capability to record a 60-second movie (and sound) — onto a standard 3.5" floppy disk!

Left flank protected, the company then went further and reinforced its right flank by releasing a digital video camcorder that could not only shoot movies on 6.35mm tape, but offer still image capture — accompanied by delivery to a supplied floppy disk adaptor or a memory card.

The floppy cameras

Sony has now covered all bases then, by updating the resolution level of its popular Digital Mavica digital still cameras, models MVC-FD81 and MVC-FD91, along with the added movie clip capability.

As the inventor of the ubiquitous floppy disk, Sony has remained loyal to the medium; the two new Digital Mavicas offer a still image resolution level of 1024 x 768 pixels as well as the attraction of a 60-second movie and sound capability.

The $1999 MVC-FD81 Mavica model is, to be blunt, a brick with a 3X zoom lens. By contrast, the $2699 MVC-FD91 Mavica has serious ambitions to be a 35mm SLR — not only in appearance but in shooting options as well.

The FD81 has a six-mode Program AE

The rear of Sony's Digital Mavica MVC-FD91, with a floppy disk being inserted to receive more images. At top is a front view of the FD91.

Sony's TRV-900E Digital Handycam isn't just for movies; it takes stills as well. The PC card adaptor slides into the camera, then the Memory Stick slips into the adaptor.

system, enabling you to shoot portraits against a diffused background. Higher shutter speeds can also be accessed in a sports mode; exposure can be maximised, generally aiding the capture of difficult subjects (bright subjects against dark backgrounds, and vice versa). Another mode forces focus to infinity, for shooting through windows, while yet another mode locks the zoom to wide and sets focus and exposure in a 'one setting suits all' position.

The F91 takes a more elegant approach, with a choice of aperture or shutter priority — plus a spot metering arrangement.

Picture effects

Only the FD81 camera has a built in 'Picture Effects' facility. Shoot your image with a tone of sepia, make it black and white, solarise it, or go 'neg art' — useful for getting a positive image from film negatives. Most of these effects could be useful at some time, although all can be emulated on your computer with even the simplest imaging software.

Exposure compensation can be manually applied in both cameras — up to +/-1.5 stops in six steps.

Most users will leave their Mavica in auto focus mode, but it's useful on occasions to access manual focus. Small CCDs (the Mavicas use a 1/3" progressive scan CCD) call for short focal length lenses; the wide-angle end of the FD81 and FD91's zooms is 5.2mm — so, in common with video camcorders (also using small CCDs), sharp focus is effectively provided right up to one centimetre from the lens' front element. Macro shooting is an easy option — as can be seen in the shot of the Voigtlander camera from the 50s.

Making a macro shot of this kind calls for careful use of manual focus — and long viewing times with the power-hungry LCD screen. Luckily Sony has the ball at its feet in the field of battery technology, having refined consumer video camcorder power supplies over the years. The Mavicas use the company's InfoLithium power packs, which not only give a minute-by-minute indication of how much power is left, but surpass all other digital still models on the market by providing up to two hours of operating time.

Both cameras use an 84,000 pixel 2.5" LCD screen. The FD81 has a 'Solar Finder' — actually a fluoro tube set above it to backlight the screen to improve daylight viewing, which it does. The FD91 allows its 2.5" screen to pivot, so you can see yourself while shooting; it also has a second, turret viewfinder — *a la* camcorders.

Most of the fine control options — image quality, resolution level, flash power (three levels), date/time, delete etc — are accessed through a viewfinder menu system, which is clarity itself.

The floppy disk is loaded into the camera's right end (viewed from behind) and is a rapidly operating (2X) Sony development.

A floppy can be reformatted within the camera, or you can elect to use the novel file copy/disk copy system to copy an image or movie onto another floppy to pass to a friend. The function can also copy Excel, PowerPoint and Word files.

Image capacities

Once a still image is shot, it takes six seconds before capture to floppy, so shooting is disabled during this time. JPEG compression (at Fine or Standard quality) is used to cram a bundle of still images onto the floppy; MPEG1 is used for movie and sound clips.

At the 1024 x 768 pixels resolution level, a floppy will hold 10-16 Standard quality images, or 6-8 Fine quality images. On the other hand at 640 x 480 pixels resolution, it will store 25-40 Standard quality or 15-20 Fine quality images. For example, a 1024 x 768 original image may be anywhere between 80-200KB in compressed JPEG form, but open to a 500KB file when opened in imaging software.

There is also an uncompressed Bitmap mode, allowing a single picture (at either of the two resolution levels) to be captured to a floppy. On test there was not a worthwhile difference between Bitmap and JPEG capture to justify much excitement — a tribute to the efficiency of JPEG.

The cameras also provide an Email mode, which effectively captures two picture files at one time; at either of the two main resolution levels a 320 x 240 pixel image will also be captured simultaneously, for Web use. Voice mode records a voice message alongside the main still image — useful for caption information.

A movie of 60 seconds' running time (160 x 112 pixels) takes around 25 seconds to commit to floppy disk; a higher quality movie of 15 seconds in running time (320 x 240 pixels) goes to floppy in the same time. The final file size for either is 1.3MB, so one 160 x 112 pixel/60 second — or 320 x 240/15 second — movie clip will fill up a floppy.

The MVC-FD81 Digital Mavica, which has a 3:1 zoom lens but otherwise offers many of the features of the FD91. Like the latter it takes 1024 x 768 still images, and also offers the ability to take 60-second video clips. At top is the TRV-900E Digital Handycam.

The differences

The FD91 has other differences: a 14X zoom lens; incorporation of the Optical Steady Shot stabiliser, useful for movie work; the ability to set colour balance manually or via three presets. The camera also has a tiny pop-up flash unit.

Image quality

In a number of situations the still image quality (at 1024 x 768 pixels) is excellent, in terms of colour and resolution. Without

doubt, these new Digital Mavicas will win many more friends.

The movie quality was adequate for Web use, but don't expect too much from a device that produces a 60-second clip (at 160 x 112 pixels), with sound, that will fill only a sixteenth of your PC screen — and still fit on a floppy.

Movies 'n stills

Digital Video camcorders with still-image ambitions have been around for a while. They are hobbled to a degree by the 680 x 510 pixel frame resolution of the DV format itself. But if you've got hours of movie footage, why not pull out some stills from the archive?

Sony's method, as demonstrated in the TRV-900 camcorder, is an elegant solution — or rather, two. At the camcorder's rear is a Type II PC card slot; into this is slipped a card-sized plate, connected to the external floppy drive. A second option is Sony's new Memory Stick (currently 4MB in capacity); a PC card-sized adaptor sleeve slips into the slot, then the Memory Stick is slid into the adaptor. From your DV movies you download stills in JPEG format.

When DV was initially launched, two cassettes were announced; one of which carried an embedded memory chip. This memory cassette enables the camera to write to tape data such as movie scene starts and ends, date and time etc — as well as exact locations of still frame bursts shot.

The TRV-900's digital still capabilities are:

- From movie sequences, you can select and transfer individual frames to the Memory Stick or floppy.
- You can shoot still images on the DV tape, then instruct the TRV-900 to locate the stills and copy them to Memory Stick or floppy.
- You can shoot still pictures direct to Memory Stick.

The TRV-900 camera has a 1.3-million-pixel three chip CCD and can shoot in interlaced (normal TV scan 50 fields/ second) or progressive scan mode (25 complete frames per second). Interlaced is ideal for movie shooting, while progressive scan will produce superior digital stills.

Other features include 12X optical or 48X digital zoom lens; a 3.5" colour screen and turret finder; Super Optical SteadyShot image stabiliser; Lithium Ion battery; extensive control of exposure, focus and colour balance; and special picture effects including sepia, neg art, B&W, solarise, slim, stretch.

The captured still is 640 x 480 pixel in resolution. Quality is OK in terms of colour and resolution.

(Barrie Smith is editor of *Australian Digital Camera* magazine.) ❖

Above: A closeup shot of a collectable 1950s camera, taken with the FD81 using the macro setting. Image quality is good...

Above and below: two shots taken with the FD91, at either end of the 14x zoom lens range.

Sony MVC-FD81, MVC-FD91 & TRV-900E digital cameras

Two digital still cameras which save images to 3.5" floppy disk, and can also shoot short video clips, plus one DV digital video camera which can also save still images to floppy disk or 'Memory Stick'.

Good points: The MVC-FD81 and -FD91 offer good image quality, plus operating flexibility and the convenience of using floppy disks for image storage/transfer. With the TRV-900E the still image capability is only of modest resolution but a handy bonus.

Bad points: Time to download an image to floppy is a little long, at six seconds. The prices are still fairly steep.

RRP: MVC-FD81, $1999; MVC-FD91, $2699; TRV-900E, $5499.

Available: Sony dealers, or contact Sony Australia at (02) 9887 6666.

The koala above is a 640 x 480 frame from the TRV-900E's DV tape. The hibiscus at right was taken with the FD81.

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Aura's Interactor Cushion

If you'd like to add more impact to your computer games, or add gut-rumbling realism to your home theatre system (especially for late-night personal viewing), the Interactor Cushion is well worth trying. It's currently available at a very attractive price, too — from Jaycar Electronics.

by Jim Rowe

IF YOU'VE EVER seen blockbuster 'disaster' movies like *Earthquake* or *Volcano* at a big-city theatre, you'll probably be well aware that very low-frequency sounds are essential to convey the full realism of a large-scale event like an earthquake or explosion. And the fact is that we humans tend to 'hear' these low-frequency sounds as much with our internal organs as our ears.

Many big-city cinemas have installed large subwoofer systems to reproduce the really low frequencies, and in trying to recreate the same effect many home theatre enthusiasts install their own subwoofer. This can be very effective, but there are two drawbacks: (a) a good subwoofer and matching amp can be quite expensive; and (b) it's hard to watch a movie in your home theatre at a satisfying sound level without disturbing others in nearby rooms. The thumpety-thump-thump can be very distracting, when you're trying to sleep!

The Aura Interactor Cushion neatly solves *both* these problems, and in an interesting way. It's essentially a low-frequency speaker/vibrator unit built into a back support cushion, so that it delivers the low frequency components directly into your 'innards' when you tuck it in behind you on your favourite viewing chair or sofa. And the really good news is that it's currently available from Jaycar Electronics, complete with its matching power amplifier module, power supply and all necessary cables, for only $49.95. This is half the original price (Jaycar apparently bought them as distress stock), and is of course much lower than most subwoofer drivers alone.

So now you can really add realism and impact to your home theatre or computer games setup — at surprisingly low cost, and in a way that will let you rumble and shake to your heart's content, without disturbing anyone else!

What's it like?

The Cushion itself measures around 430 x 330mm, and has a 'lumbar support' shape with a maximum depth of about 90mm. It's well padded with polyurethane foam, and even with it pressing into your back you're not really aware of any 'hard lumps'. But inside, there's a sturdy and very effective bass driver-cum-vibrator unit, as you soon discover...

The matching amplifier unit is housed in a compact plastic case, measuring 203 x 105 x 67mm overall, with an accompanying sturdy 'brick' type power supply measuring 90 x 75 x 64mm. The supply is rated at 23V CT at 1.25A, suggesting that the amp is rated at somewhere around 12W output continuous (probably more on peaks).

Jaycar very kindly sent a copy of the amp's schematic with the review unit, and as you'd expect there's a power amplifier — in this case with a TIP41B/42B discrete complementary pair, with good heat sinking and preceeded by a discrete driver/op-amp combination. There's also selectable low-pass filtering, plus some frequency divider circuitry — presumably to augment the signal's own ULF components with additional subharmonics.

There's also an active clipping indicator, which drives a red LED to indicate when you're pushing the cushion's driver too hard.

On the outside of the case, apart from the 'Power' (volume/on-off control) and 'Filter' (LP filter control) knobs and the clipping LED, there's a green power LED; a 'Normal/A/B' switch, to select either full bandwidth or two levels of LP filtering; a 'Music/Game' switch (which seems to change a muting threshold); a three-pin DIN socket for the low voltage power input; a 3.5mm stereo jack for the audio input, and an RCA-type socket for the output to the cushion. It's all quite neat and functional.

There's no shortage of cables, either. The cushion itself has a cable about 3m long, to hook it to the amp, and the power supply has mains and LV cables attached, with all connectors. You also get an audio input cable about 5m long, with 3.5mm stereo plugs at each end; a 'W' adaptor cable, with RCA plug and socket pairs and a 3.5mm stereo socket, so you can patch the Interactor into an existing stereo line between say a VCR and amplifier, or whatever; a 'Y' adaptor, with two 3.5mm sockets and a 3.5mm stereo plug; and a 3.5mm to 6.5mm stereo jack adaptor. One way and another, you get just about everything you'd need to hook up the cushion to most home theatre or multimedia computer systems...

By the way, the Interactor Cushion also comes with not only a small and fairly comprehensive user manual, but also a double-sided A4 'Quick Start' sheet showing clearly how to hook it up to four of the most likely entertainment/computer setups, and finally a small sheet on how to use the 'W' cable adaptor.

Trying it out

I tried out the sample Interactor Cushion with my own modest home theatre setup, using both videotapes played on a standard VCR, and also material on a borrowed DTS-demo DVD video disc, played on the Kenwood DVF-5010 DVD player (which I was able to borrow over the Christmas break, after Louis Challis had reviewed it).

Frankly, although I was a bit skeptical before I tried it, I found myself very impressed with the Interactor's performance. During the video of *Terminator II*, I could really 'feel' the impact of those crashes and explosions. The DTS demo disc also had excerpts/enlarged trailers for both *Titanic* and *Apollo 13*, and the impact of these was most dramatic — I could really feel the impact of that iceberg, and the rumble when Apollo was launched made me feel like I was in that capsule along with those astronaut/actors!

The nice part too is that even someone sitting at the other end of our sofa really wasn't aware of, or disturbed by, the output from the Interactor Cushion. So it's great for late-night home theatre viewing...

I did find the user manual a bit cryptic and unforthcoming in its description of the controls, and there's no real technical specification. Still, it doesn't take much experimenting to find the settings that work best for you.

In short, then, the Aura Interactor Cushion really works, and would be an excellent low-cost enhancement for a home theatre or multimedia computer setup. But you'll probably need to snap one up very soon, if you're interested. At this price, they probably won't last long!

Oh — by the way, Jaycar can also supply a 'backpack' version of the Interactor, if you'd prefer one (Cat No. XC-1000, $39.95). They can also supply the ULF driver/shaker motor separately (XC-1008, $24.95), if you want to build it directly into a couch, computer chair or car seat. ❖

Aura Interactor Cushion

A 'feel the impact' ultra-low frequency sound reproducer, built into a convenient 'lumbar support' cushion.

Good Points: Comfortable, delivers 'gut rumbling' bass very well for a single user. Package includes amplifier, power pack and everything else needed, for a very attractive price.

Bad Points: Nothing really — although the user manual doesn't explain control operation very well, so you have to experiment.

RRP: $49.95 (Jaycar Cat. No. XC-1005)

Available: Jaycar Electronics stores, or order by mail through 1800 022 888, or **mailorders@jaycar.com.au**.

When DID Our Radio Broadcasting Really Begin?

For many years radio historians have accepted November 13, 1923 as the day Australian broadcasting began. In researching the beginnings of broadcast radio for 2BL Sydney and the National Film & Sound Archive, a Canberra journalist has uncovered some intriguing detail along the way...

by Richard Begbie

IN HIS BOOK *The Dawn of Australia's Radio Broadcasting*, published by *EA* in 1993, the late historian Phillip Geeves left us a lively description of the beginnings of broadcast radio in this country. Like every writer since 1923, Geeves gave the prize of first official broadcaster to 2BL Sydney (or 2SB, as it was in 1923). And like most historians and archivists, he sets the opening on November 13 of that year:

The station was officially opened as 2SB on Thursday 13th November 1923 by the Postmaster-General, acutely conscious of its primacy as Australia's first public broadcasting station...

As the 75th anniversary of the great day approached last year, I became involved in checking background detail for 2BL's celebrations, as well as for an exhibition being mounted by the National Film and Sound Archive. Anyone involved in research legwork knows how tedious it can be, but this time round it led to some absorbing twists and turns in an already fascinating tale.

Geeves' account was a natural starting point, and his start-up date is confirmed as far back as 1938, when Sir Harry Brown delivered his paper on 'Broadcasting in Australia' to the prestigious World Radio Convention. Surely you could be fairly confident if a one-time Director of the PM-G's department listed 2BL's debut as November 13...

Meanwhile Ray Kelly, founder of the Historical Radio Society of Australia, had generously provided access to his precious bound volume of the first 12 months of the magazine *RADIO*, often remembered by its full title *Radio in Australia and New Zealand*. Put out by Wireless Press, an AWA subsidiary, it follows the race towards broadcasting through 1923. And there, in the Boxing Day number at year's end, is a brief piece reporting the official opening:

On Thursday evening, December 13, the Postmaster-General (Hon. W.G. Gibson) officially opened the broadcasting station erected and operated by Broadcasters (Sydney), Ltd., in conjunction with Smith's Newspapers, Ltd.

December? A second look confirmed the deepening mystery. In fact this modest report at the trivia end of an AWA-backed magazine tells a great deal about the sprint to be first in 1923. As does the story of AWA boss Ernest Fisk and the flamboyant Sir Joynton Smith.

By early 1923, Fisk had already put out feelers for a partnership with the Federal Government which would give AWA pre-eminence in the coming broadcast medium. This was no shot in the dark — the Commonwealth enjoyed a cosy relationship with AWA, with a 50%-plus shareholding.

Others, less commercially orientated than Fisk, were concerned to preserve the freedoms of the amateur experimenter, as well as to block any commercial monopoly of broadcast. To this end George Taylor, an early adventurer in more fields than radio, formed the Association for Developing Wireless. Through the Association, other interests in the embryonic industry backed Taylor's request for a conference with the Government, on the shape of broadcasting. All interested parties were to be invited.

When the new Bruce-Page government was elected early in 1923, a date for this conference was raised as a matter of urgency with the new Postmaster-General. The Hon William Gerrand Gibson and Taylor's group soon settled on April 9, and detailed plans were set in train. Then someone (history does not reveal his/her identity) discovered

The only known picture of equipment believed to have been used first in Paling's music store, then in trial 2SB broadcasts from the Daily Guardian building in October-November 1923.

What the competitors were using: the earliest known photo of 2FC's first control room at Farmers & Co, built by AWA.

the fatal flaw with that date: E.T. Fisk would not be in Australia. He was in Britain pursuing another passion, a direct radio link between Australia and 'home'.

A Federal Minister and all other commercial radio interests in the country were hastily re-scheduled to accommodate, perhaps even appease, one man. The new date of May 24, celebrated then as Empire Day, seemed especially apt for the anglophile Fisk.

So as he took his seat at the conference he was not just another delegate. When proposals for a broadcasting structure were called for, all eyes turned to the enigmatic Ernest. He made it clear that he had a complete proposal, but that he also wanted to hear other ideas first. There were none — or at least none was expressed. Into this profound silence Fisk dropped his plan, and with minor modifications over several days' discussion, it was substantially adopted.

Its most infamous feature was the proposal that sets be tuned to fixed wavelength(s) of one or more stations and sealed by the PM-G or his representative. The poor subscriber would be obliged to pay a government fee and station fee(s), for the privilege of access to one or more stations. And then, of course, there was the royalty on patents held by AWA...

Everyone said later they'd always thought it was a rotten idea, but no one said so then. Such was the power of Fisk.

RADIO was only a few issues old. Now it turned the weight of its pages to promoting (a) broadcast radio and Fisk's scheme, (b) AWA's sealed sets, and (c) 2FC, the big new station planned by Farmer's and Co. The magazine saw the building of 2FC as 'the second great step in radio broadcasting in Australia'. Fisk's scheme was naturally the first, while 2FC's first broadcast would 'mark the third great step in the history of radio in Australia'.

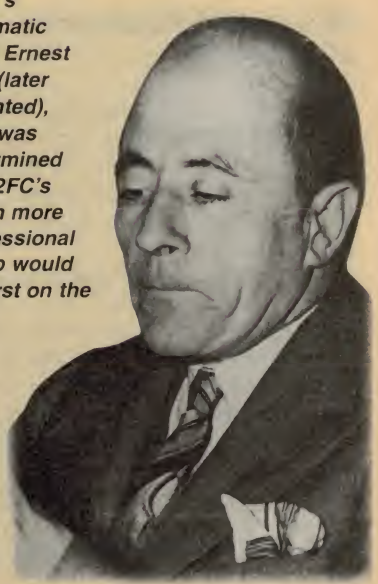
AWA was staking its already considerable reputation on 2FC, and Fisk clearly saw it as the trail blazer. It would be the first, and the best. The only slender shadow of competition as late as October was a struggling group of small retailers assembled by W.J. Maclardy, editor of *The Wireless Weekly* — *EA*'s direct ancestor, and press rival to *RADIO*. But the consortium of Broadcasters (Sydney) Ltd had little of AWA's commercial clout or leverage with government.

All of that suddenly changed in October. Sir Joynton Smith, colonial gambler, entrepreneur extraordinaire, Mayor of Sydney and owner of the successful Smith's newspaper chain, had always enjoyed a punt. Maybe this radio was the coming thing. He offered backing and a co-promotional deal to the cash-strapped Broadcasters, so long as they agreed to transmit from his *Daily Guardian* building in Sydney's Phillip Street.

The race was on!

Now the race was on in earnest. Maclardy conscripted Ray Allsop, who had already set up a successful demonstration transmitter for New Systems Telephones in Paling's music store. Mr E. Joseph, another well-known expert, joined the team, and under Maclardy's 2HP callsign experimental transmissions were beamed out of the *Daily Guardian* location from late October.
(The equipment used in this experimental period has an uncertain history. The tag on a photograph in the ABC archive, almost certainly of Allsop's rig for Palings, suggests the Paling's gear was used for testing at Phillip Street while the new transmitter was built.)
On November 1, the *Guardian* carried the triumphant headline FIRST IN THE FIELD! above a confident announcement that

Key players in the 2SB/2FC race to begin broadcasting in 1923: above is pioneering radio engineer Ray Allsop, who was conscripted by W.J. Maclardy (below, also editor of Wireless Weekly) to set up 2SB's 'home brew' transmitter.



AWA's enigmatic chief Ernest Fisk (later knighted), who was determined that 2FC's much more professional setup would be first on the air...

Broadcasters would inaugurate 'The First Free Radio News and Amusement Service in Australia' on November 15 (not 13). The speed was breathtaking. Suddenly 2FC's primacy was under threat.

November 15 dawned, and with it another large *Guardian* announcement, this time in a tone distinctly peeved (see panel). Its testy text suggests there was no good reason for the Commonwealth's refusal. Between its lines lies the question what, or (more likely) who is behind this delay? In similar strident tone *Wireless Weekly* is asking the same questions at the same time.

There is no record of the negotiations which ensued. It would seem fairly certain that the larger-than-life figure of Joynton Smith played a significant part. All we know is that on November 22, the Postmaster-General's department suddenly found it possible to pass those same sets offered by the traders who made up Broadcasters. The *Daily Guardian* wasted no time. On the 23rd the triumphant headline appeared:

'FREE BROADCASTING - HERE AND NOW.'

The article's copy is a time-piece worth quoting at length. It begins:

Anticipating the day when 'radio' will be taught in the schools; when the listening plant will be as familiar as the domestic mangle; when the radio 'phone will be in everyone's pocket; when a whole generation will grow up unconscious there ever was a pre-radio era, Broadcasters (Sydney) Ltd., in association with 'The Guardian', will begin a free broadcasting service tonight. It will be the first in Australia. It will not be the last, of course, because success will breed emulation. But where the Broadcasters and 'The Daily Guardian' lead, others are welcome to follow.

So it came about that on that night of November 23, Miss D. Deering stepped up to the 2SB microphone, and broadcasting had officially begun. How those 'others' must have squirmed. It was only a few weeks until 2FC was to begin its highly successful series of tests, but Broadcasters had won the day, and with it the crown of first in Australia.

DAILY GUARDIAN - November 15, 1923

Broadcasters (Sydney) Limited

Announcement

OWING to the Commonwealth Government refusing to pass the Broadcast Receiving Sets at present being offered for sale by the Wireless Traders of N.S.W., Broadcasters (Sydney) Limited have been compelled to postpone the official opening of their service.

Within the next few days the official opening date will be announced in these columns.

On November 15, 1923 Sir Joynton Smith's Guardian published this somewhat testy notice — hinting at political reasons for the unexpected delay in broadcasting.

Meanwhile, what about that *RADIO* report that 2SB's official opening happened on December 13, nearly a week after 2FC had begun full testing?

Well, although it may have 'accidentally' left its readers with the impression that 2FC was at least equal first, it was also quite accurate. Despite the fact that official broadcasts under the new system did begin on November 23, the official opening of the new station took place on December 13. The Postmaster-General, a political creature to the last, was happy to turn up for the ribbon-cutting after 2FC was on air.

The December 13 event, incidentally, was a grand affair. 'Receiving plants' were set up in picture theatres and stores around town. The Tivoli, Fuller's Vaudeville Theatre, and the King's Cross Theatre made a special feature of the night. A big demonstration in the Real Estate Institute's Hall was backed up with a large outdoor setup in Martin Place. Crowds gathered around Coogee's famous Poster King's stand, where huge horn speakers relayed the event. Now Sydney knew that radio had arrived.

It made such a splash that this date is surely the source of the ancient error picked up by Geeves. It seems most likely to have been a conflation of two historic givens — the start of broadcasting in November, and the big night on the 13th, albeit of December.

The story of the race to broadcast between powerful media interests has an eerily contemporary ring. Even more so when you discover the small print at the foot of the *Daily Guardian* page concerned. *Printed and published*, it reads, *by Robert Clyde Packer of 'Awanui', Wunulla Road, Woollahra, for Smith's Newspapers Company, 120-128 Phillip Street, Sydney, NSW.*

More so still when you realise that Robert Clyde's son Frank, at the tender age of 17, had just begun as a cadet journalist on — you've guessed it — *The Daily Guardian.* ❖

'Waves Of Pleasure' at the NFSA

The celebration of broadcast radio's diamond jubilee will continue well into 1999 at the National Film and Sound Archive in Canberra. The Archive has mounted an exhibition entitled 'Waves of Pleasure', which it plans to expand as the year unfolds.

Already it features a magnificent display of early Australian broadcast receivers. This 1920s section of the exhibition owes much to the generosity of Historic Radio Society member Ralph Kettle, who has made available some of the very best surviving examples of early equipment, and a good representative selection is on display.

AWA is of course well represented, though not, alas, by a sealed set. So is the United Distributing Co. (Udisco), from a small single valve set to the mighty Super Six. To go with these are some of the finest of Amplion, Gecophone and Magnavox horn speakers. Sound grabs from the period feature Gladys Moncrieff and an early race call of Peter Pan winning the 1932 Melbourne Cup.

But the exhibition goes far beyond the 1920s. It looks into the back shed, and examines the do-it-yourself aspect of the developing medium in an era when many people did. There is a segment devoted to one of the most famous DIY sets of all: the 'Little Jim' which was such a hit with *Radio & Hobbies* readers back in 1939.

Some of the most handsome receivers of the golden age of radio will be featured. An integrated mock-up of suburban interiors from the 1930s to the 50s will give a first-hand feel for radio in the context of its time. Period posters, rare photographs, ads and untold memorabilia will evoke the time when radio was king.

Anyone old enough to remember radio as the centre of home entertainment will have memories brought back by out-takes from many of the best known radio programs of the 40s and 50s. The Archive theatrette will be given over to some splendid black and white footage of programs being made in the radio theatres of the 1940s. The sound-effects man is revealed in all his hilarious glory, as the incomparable Jack Davey takes us behind the scenes.

'Waves of Pleasure' puts radio in its social and historic context, and the result expands what might have been merely a display for buffs and collectors into an outing for all the family. It can be seen in the main gallery of The National Film and Sound Archive at McCoy St., Acton, which is in the grounds of the ANU, and should make a fascinating addition to any Canberra visit.

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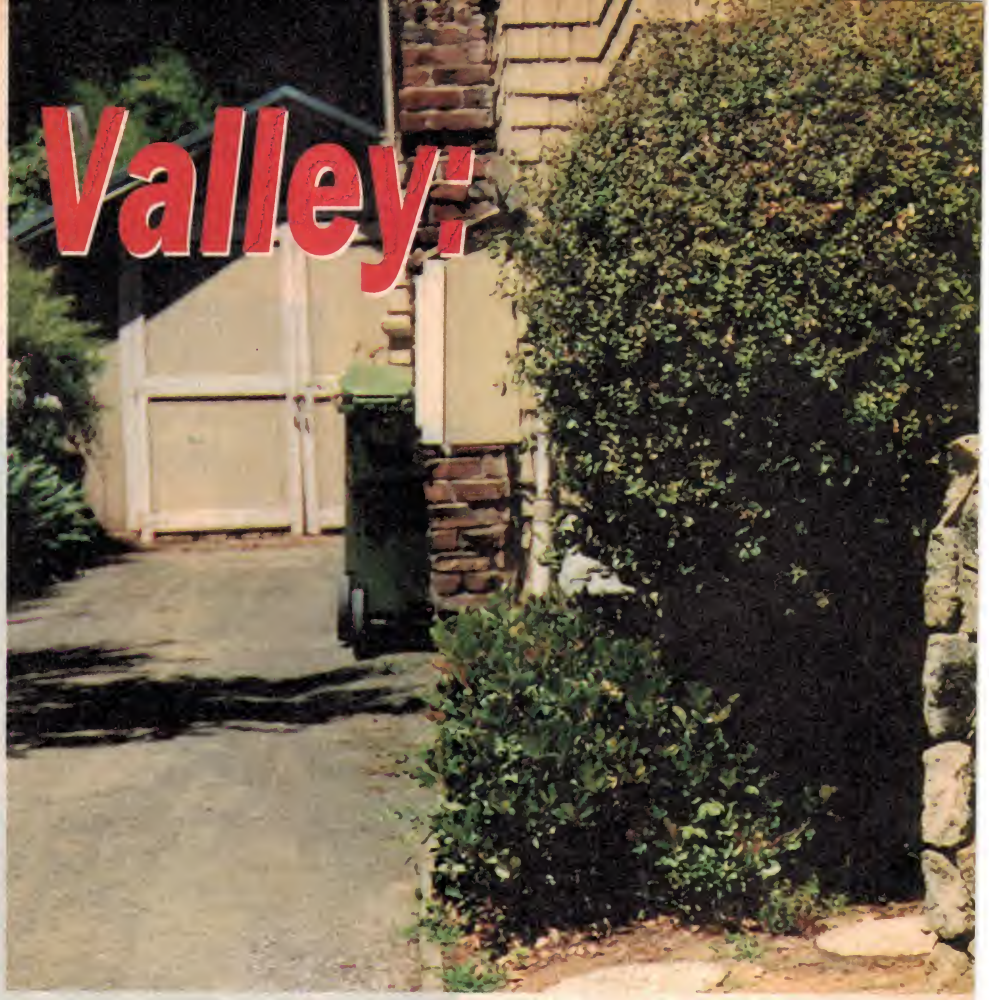
READER INFO No. 5

Silicon Valley: It's Come a Long Way!



It's 20 years since our Silicon Valley correspondent Paul Swart moved to the Valley, and he's decided to mark that milestone with this article on what's happened in those 20 years — and what's likely to happen there in the future.

by Paul Swart

AS THE SMALL commemorative plaque states, it all started in 1939 in the garage in downtown Palo Alto, where Dave Packard and Bill Hewlett built their first audio oscillator for Walt Disney's *Fantasia*. The Valley's history has since taken on an astonishing course that easily rivals anything seen in the modern industrial era.

Through global recessions, high-tech slumps, paradigm shift after paradigm shift in the high-tech market, massive foreign competition and the end of the Cold War, the Valley has thrived, and if anything, only expanded its global high-tech leadership role. Today, Highways 101, 237, 280, 680 and 880 are the main arteries that channel hundreds of thousands of workers to the 8000+ high-tech firms that call the Valley home.

Silicon Valley has become the centre of gravity, not only for its traditional semiconductor industry, but for a broad range of key technology sectors that form the pillars on which today's information technology revolution in built. The Valley today leads the world in:

- **Semiconductor Production**: Perhaps the most under-appreciated industry sector on the planet. Chipmakers take most of the media spotlight with their latest microprocessors and other chips, and even the local newspapers in the Valley rarely cover the launch of a revolutionary new etching, CVD, lithography or other type of IC production system. But without those multi-million-dollar marvels, IC makers wouldn't be able to add a single hertz or transistor to their new ICs.

Computers, cellular phones, consumer electronics product, and every other semiconductor-driven product couldn't improve if it wasn't for the companies developing the ever-more sophisticated equipment. Tools which today allow chipmakers to design transistors so small you could lay 500 next to

An overview of Intel's massive complex in Santa Clara, pieced together from two separate shots. Intel has many other facilities, but this is their headquarters.

each other on the width of a human hair — or in the case of Texas Instruments and its just announced 0.07-micron technology, 1200 would fit the space.

Applied Materials, Lam Research, Novellus, KLA-Tencor, Ultratech, Watkins Johnson, Perkin-Elmer, Silicon Valley Group, and Varian are all headquartered in the Valley, along with some 500 smaller equipment companies. That is one-quarter of all equipment companies in the world and more than in any other country, including the rest of the United States. With sales in excess of US$15 billion, the Valley's equipment firms are responsible for nearly half the global equipment market.

- **Microprocessors**: Intel, AMD, Cyrix/National Semiconductor and IDT control 95% of the world's market for PC microprocessors, easily the most important class of semiconductors and arguably the most important single product of the modern industrial age. Is it any coincidence that no company outside the Silicon Valley has even entered this hugely lucrative market segment? Add to this the dominance of the likes of Sun Microsystems and its Unix-market dominating Sparc processors, and Silicon Graphics with its MIPS processors that continue to power the world's most powerful graphics workstations.
- **Other Semiconductors**: Though the chip business must share the spotlight with half a dozen other major high-tech sectors that have risen to prominence, Silicon Valley today still lives up to its four-decade-old reputation as the centre of the silicon chip revolution. Silicon Valley is not a player in the market for DRAM memories, chips most IC engineers here regard as a low-tech commodity they 'wouldn't want their hands to get dirty on'. Any interest in memories here is in higher-level circuits such as Flash and high-performance SRAMs (AMD, Intel, Cypress and IDT).

Hundreds of chipmakers still dot the Valley's landscape. Some are well-known, such as Intel, AMD, National Semiconductor, LSI Logic, Integrated Device Technology, Cypress Semiconductor, Cirrus Logic, Zilog, Altera, VLSI Technology and C-Cube. Most of the smaller firms are IC design houses who contract out their production. Most offer leading-edge ICs that serve specific niche markets such as digital video display, automotive electronics, defense electronics and consumer electronics. In all, Silicon Valley firms produce a third of the world's US$130 billion in annual chip sales.

- **Semiconductor Design**: Cadence, Avant! and Synopsys dominate the market for advanced IC design systems.
- **Networking**: Cisco, 3Com, Ascend, Bay Networks, Fore Systems and Network Associates are all based in the Valley. None were mentioned, or ever considered for a similar article I wrote 10 years ago. They either didn't or barely existed. Today they produce some US$50 billion worth of networking products that form the backbone of the Internet-based information and communications revolution.
- **Data Storage**: Through the ups and downs of the violently volatile data storage market, Silicon Valley has remained the far-and-away dominant force in this vital market segment. Seagate, Maxtor, Quantum, and IBM (with its San Jose-based data storage products division) are the market's dominating disk drive suppliers. Ten years ago, a 20 megabyte disk drive retailed for about $500 at Silicon Valley's Fry Electronics store. This weekend, a 6.4-gigabyte Maxtor drive can be had for $152, representing a nearly 1000-fold price/performance improvement.
- **Software**: Microsoft may be located a few hundred miles to the north of Silicon Valley, but the area offers leadership in many areas of software:

Oracle, Sybase and Informix lead the world of database software.

Apple's QuickTime multimedia software is so superior to Microsoft's counterpart that the latter had to allegedly try to bribe Apple not to execute its QuickTime marketing plans.

Sun Microsystems' Solaris OS dominates the Unix market and its Java Internet programming language is posing one of the most serious challenges to Microsoft's long-term dominance of the desktop.

MacroMedia and Adobe dominate the market for multimedia development software.

Broderbund and Electronic Arts control much of the learning software markets, while Intuit remains the dominant force in personal financial software.

PeopleSoft is yet another giant, in its market of enterprise management software.

Author Paul Swart, who has been reporting Silicon Valley news for 20 years...

- **The Internet**: Netscape, Yahoo, Java, E-Trade, eXcite, Lycos, Infoseek, US Web, @Home and WebTV are but some of the key players in the movement that has enabled the Internet to become the main highway over which most information is exchanged and electronic commerce is conducted.

The list could go on. In fact:

- Hewlett-Packard should have its own category, for dominating the global PC printing market. HP today has also battled itself into the exclusive club of Top Five PC producers, and propelled itself to be second only behind IBM in the computer market. HP was surpassed by Compaq this summer, when the latter acquired Digital Equipment and (Silicon Valley-based) Tandem Computers.
- Sun Microsystems dominates the Unix Workstation market as never before.
- And no article about Silicon Valley is complete with the mention of Apple Computer, the Valley's perpetual darling and problem child.

In the midst of yet another improbable come-back, Apple continues to dazzle the PC industry with new software and hardware innovations that Bill Gates can only dream were available on the Windows platform. Its

latest product, the iMac sold close to 200,000 units in pre-release orders and is quickly becoming America's latest status symbol in home information appliances.

Continued strong demand for the stylish US$1300 machine has boosted Apple's shares to $45, triple their value a year ago when Steve Jobs took back control of the company as interim CEO and forced it to return to its roots of 'thinking differently'.

So much in so little

AWESOME certainly wouldn't be too excessive a description for the Silicon Valley. And we haven't even mentioned the fact that the Valley continues as the largest or second largest areas for defense electronics, aerospace technology, and biomedical and genetics technologies.

All of this high-tech industrial power is concentrated in an area that stretches for only about 20 miles northward from San Jose, on both sides of the south end of the San Francisco Bay. With overall high-tech sale of around US$350 billion, Silicon Valley today is the most productive industrial area in the United States — exceeding the Detroit, New York, Chicago and Los Angeles metropolitan areas. Silicon Valley companies exported US$40 billion worth of products to other countries in 1997, a quarter of the state's entire exports — which included California's huge agricultural, entertainment, and wine businesses.

Also in awe of the Valley's staying power as the centre of the technology universe, is the US Congress. This summer has seen a steady parade of 'fact-finding' field trips by dozens of US Congressmen and Senators, visiting the likes of Applied Materials, E-trade, Sun Microsystems, Netscape and Yahoo, to learn first-hand the visions of 29-year-old Internet junkies who have become billionaires overnight.

The main corporate office building at AMD's headquarters complex in Sunnyvale — generally referred to in the Valley as 'The White House'.

Only growth ahead

THOSE WHO DOUBT whether Silicon Valley's success story could get bigger yet are surely to be proven wrong. One only has to consider the stream — make that a flood — of venture capital that keeps flowing into the area. During the last four quarters, a record US$3.8 billion was invested in new and existing Silicon Valley companies, nearly one-third of all venture capital money made available to the vast US industry during this period.

Software/Internet firms attracted the largest share at US$1.45 billion, a 140% increase from the 1996 investment level. Communications, the largest recipient in 1996, received 25% of 1997 investment capital. In 1997, 3595 new companies were formed in Santa Clara County alone, up 14% over 1996.

The Valley has added some 150,000 new high-tech jobs in the last six years. New high-tech jobs are created at the rate of 30,500 a year.

So intense is the focus on Silicon Valley as the promised land of high-tech innovation that many global conglomerates are setting up their own venture capital funds in Silicon Valley, to be part of groups of investment teams that underwrite promising start-ups. Germany's Siemens, which already has substantial investments throughout the Valley, announced early in August that it has set up a US$300 million Silicon Valley venture capital fund to help jump-start promising networking and telecommunications ventures.

Life in the Valley

YOU KNOW YOU'RE IN Silicon Valley when every other highway billboard doesn't sport the Marlboro Man, scotch whisky or some insurance scam, but a message for a high-powered specialty IC, graphics board, engineering workstation, networking hub, or some other exotic item few inhabitants of the planet would have a clue as to what they're looking at.

The uniqueness of Silicon Valley is clearly present in everyday life, in the area where I moved in October 1978 to cover the latest developments in the area's electronics industry, for a new UK start-up trade publication called *The Electronics Times*. Whether it's during or after business hours, you can't get away from the high-tech industry or the people who built this valley into what it is today. Many close friends and acquaintances are executives at major Silicon Valley high-tech companies. Several are heads of start-ups, with products ranging from the latest in GPS (global positioning system) to PC-X servers to telephone network servers.

It is not uncommon to run into the men who have built Silicon Valley, or who are busy making it even bigger. Two weeks ago, for example, while I was having lunch at Coco's Restaurant in Sunnyvale, AMD chief Jerry Sanders walked in with a business associate and was seated in the next booth. Unlike Hollywood celebrities, the Valley's industrial megastars can move about freely without being haunted by fans or paparazzi.

Silicon Valley has its own set of work ethics. It is generally assumed that a salaried employee puts in at least 50-60 hours a week. An incredibly high percentage averages 60+ hours. And it's not because people fear losing their job — not with an average of 50-70 pages worth of employment ads in the local Sunday newspaper. It's simply because work in the valley's high-tech industry has an addictive element. The contributions individuals typically make to the growth of their companies is staggering by comparison to most workers in the industrialized world.

And the rewards can be staggering as well. With stock options generally and generously available to anyone with a particular talent, a bit of hard work can pay off to the tune of millions, if not tens of millions of dollars when start-ups go public or grow into billion-dollar market leaders.

There are few places on earth where being laid off is considered a blessing, but it is here. The downfall of one company means new opportunities for laid off workers to enjoy a change of working environment and join a company with better growth potential. Anyone with engineering, marketing, sales or other skills not only won't have any trouble finding new employment; many end up with higher titles and income.

That's because while some of the bigger firms may be laying off scores of employees during a business slump, there are literally hundreds of small companies — especially start-ups — dying to get their hands on skilled high-tech workers, especially those who know what it's like to work for large, fast-growing high tech companies.

So why doesn't Silicon Valley attract legions of technical talent from around the US and the world, for a chance to get in on the action? Well, imported technical labour

Most major US and foreign companies have set up R&D operations. IBM's Almaden Research Lab is legendary for its far-out developments, such as the recently announced quantum physics-based transistors. Fujitsu has nearly a dozen product divisions headquartered in the Valley, including its laptop group.

Of any prediction about the future of Silicon Valley, it appears certain above all else that 10 years from now, a new crop of companies, funded with today's venture capital, will have grown up to rank among the leaders in markets worth tens of billions of dollars — markets which today are embryonic, if they exist at all.

Moore's Law

FOR NOW, Gordon Moore's Law, that symbol of Silicon Valley's frantic technology revolution, appears safe. Moore's Law dictates that semiconductor companies double the number of transistors on a chip every 18-24 months. At least all of the pieces of the technology puzzle appear to be in place, to keep that mind-boggling achievement going for another 10-15 years.

Between next-generation versions of today's state-of-the-art IC production tools, new copper interconnect technology, double-duty transistors, new insulating materials and other key achievements, the tools to make ever more powerful chips will be available for chipmakers when they want them.

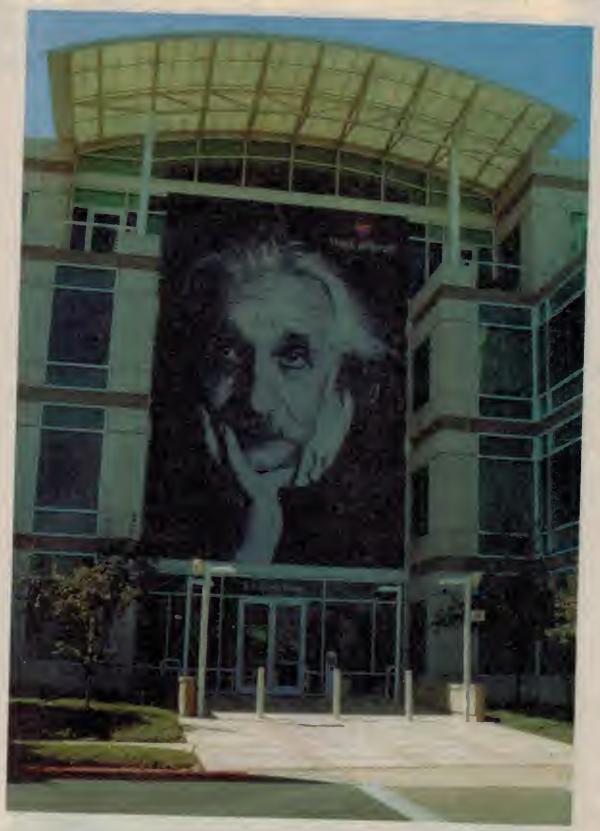
But Moore's Law seems to be in *some* danger of derailing, under the weight of vast chip production capacity glut which has brought on a three-year crisis in the memory market — compounded by the rapid decline in profitability in the microprocessor market due to new competition. The global IC capacity glut has vastly reduced, if not all but eliminated, the ability of many large chipmakers to invest in the new plants, equipment and technology that must produce the next generations of advanced chips.

A new generation of 300mm wafer fabs, for example, may be delayed by three to five years as chip companies simply don't have the money to build them.

A huge re-alignment in the IC market may soon take place, as a result of the malaise. We've seen the first such moves earlier this year, when Texas Instruments first bailed out of joint memory ventures with Hitachi and Acer, and subsequently abandoned the memory market altogether. Korean memory makers such as LG Semicon and Hyundai are re-evaluating their committment to the DRAM segment.

Potentially the Japanese, who once dominated the DRAM market, could be forced out, or have their role diminished under the weight of their domestic economic stagnation and high domestic operating costs when compared to Korean and Taiwanese producers.

Micron, the sole US producer of DRAMs after the exit of Texas Instruments, appears determined to become a world leader in this market. With Korean and Japanese competitors hurt badly and Taiwanese chipmakers due to run out of money at some point in the unprofitable DRAM future, Micron may well end up becoming the Samsung of the next decade.



The front of Apple Computer's 'Infinity Loop' headquarters building in Cupertino, with a giant poster of Albert Einstein as part of Apple's 'Think Different' promotion.

Feud to continue

ONE OF THE most bewildering spectacles of the 1990s was the turf war between AMD and Intel, over AMD's right or ability to produce clones of Intel's microprocessors. At one time, as many as a dozen lawsuits were being fought simultaneously

is limited by US immigration quotas, and many qualified US engineers simply cannot afford to move to the Valley. The median price for a single family home in Santa Clara County has rocketed to US$320,000. That typically gives you a 20-year-old, two- or three-bedroom home in a so-so neighbourhood where private schools are the only way to ensure your children will end up with a decent education. Renting is not a cost-effective alternative either: decent two-bedroom apartments fetch from $1400 to $2500 a month.

Engineers in Texas, Oregon, Arizona, New Mexico, South Carolina and other states with a considerable high-tech industrial base usually live in spacious homes, in top-notch neighbourhoods with highly regarded public schools. Homes that would fetch about $250,000 in the local real estate market there, would cost $500,000 and up in Silicon Valley. Few people are willing to take a huge step down in living standard for the privilege to move to the Valley. For that reason high-tech firms are finding it impossible to fill the more than 40,000 high-tech job vacancies currently available in the Valley.

The only alternative is to buy one of the relatively nice, new and affordable homes in cities outside the Valley such as Tracy, Fairfield and Gilroy — all of which require a minimum 90-120 minute drive during peak traffic hours to reach the business parks of Silicon Valley. Not exactly something to look forward to, on a daily basis.

So why do companies put up with the high wages, scarcity of qualified workers and other negative factors of doing business in Silicon Valley? There simply is no place on earth that offers the kind of dynamic environment for high-tech companies to flourish. Offer a competitive wage, and a single employment ad will overload the HR fax machine with resumes from people offering just about any technical expertise you can imagine. High wages continue to be a drop in the bucket when compared to the pay-off when a new innovative product hits the global marketplace. It's a price most companies eagerly pay for the privilege of operating in Silicon Valley.

Other aspects of the Silicon Valley still hold true today as they did when the Valley got its start some 50 years ago. The climate is close to ideal — rarely hot, never cold, mostly between 60 and 80°F. I have grapes, orange, lemon, grapefruit, banana, peach and plum trees growing in the backyard. It takes 45 minutes to get to San Francisco and all the attractions that city has to offer.

The Valley is also but a 45-minute drive away from Carmel and Monterey along the Pacific Ocean, and four hours from Yosemite Park for spectacular hiking trips and the Sierras Nevadas for snow skiing, and just about any other form of outdoor recreation.

Stanford and UC Berkeley are still on top of the educational world, and Las Vegas is but an $50 plane ride away. For sport lovers, golf and tennis can be played year round. There are six top professional football, baseball, basketball and hockey teams in the San Francisco Bay Area, which also usually finds itself at or near the top of the world tour lists of every major musical and theatre act.

All in all, Silicon Valley is a pretty good place to call home.

between the two firms, many bordering on the absurd or silly as Intel desperately fought to retain its stranglehold over the Windows PC microprocessor market. In the end, the settlement reached between the two firms shifted the battleground from the courtroom to the marketplace, where AMD is once again giving Intel a run for its money.

Who will prevail is far from certain. You can make a convincing argument for Intel to be as dominating a force 10 years from now as it has been up until 1998. But in the interim, the company appears in for a rather rough ride.

Intel's sales are declining, profits are dwindling, prices for microprocessors have plummeted, and the company is getting a beating in the low-end of the PC market it hasn't seen since AMD 'cleaned its clock' in the market for 386 chips a decade ago.

Intel has been blind-sided by the explosive growth of the sub-$1000 PC market. According to the latest market research data, Intel's share of the market for sub-$1000 PC processors has plunged, from 72.3% in July 1997 to 34.8% in June 1998. AMD's share of this booming market has skyrocketed from 3.8% to 51.2%.

Intel's share of the overall consumer PC market has also plunged from 91% a year ago to 60% today. In foreign markets, AMD's star has risen meteorically as well. In Japan, AMD now has 40% of the low-end PC processor market, up from 1% a year ago. Intel has slumped from 98% to 60%. Clearly, consumers are settling for computers that sport speeds 20-30% below the state-of-the-art, but which are certainly fast enough to handle the vast majority of consumer-oriented computer tasks.

Intel's first attempt at entering the low-end market turned into a public relations fiasco, as its Celeron chip was declared dead on arrival and has performed in accordance since. A new Celeron chip was launched in August, but how many manufacturers will give it serious consideration remains to be seen.

For at least the next two to four years, AMD appears in position to remain extremely competitive with Intel, especially after having secured Motorola's copper-based processing technology. This means AMD will be able to offer a huge boost in the performance of its K6 and future K7 processors without having to incur the usual massive investments in R&D, new plants and equipment.

Intel's problems may only get bigger in the years to come. AMD has clearly established a large base for its processors and gained credibility with many major customers. From this base, the company may well move aggressively into the higher end of the processor market, giving Intel a run for its money where the company still enjoys dominance and the ability to control pricing.

Intel should not be counted out by any stretch of the imagination, although the firm may have to sacrifice short-term profitability to regain some of the lost marketshare. Intel can be expected to accelerate the release of powerful new processors in an attempt to create a large enough performance gap with AMD and Cyrix processors to reign in consumers — who no longer appear too concerned about having 'Intel Inside' their computers.

The corner of Fairchild Drive and Ellis Street in Mountain View was once the epicentre of the IC universe, but the old Fairchild Semiconductor complex has largely been replaced by Netscape's headquarters.

But like memory chipmakers, Intel may well encounter some very unprofitable times ahead, or at least unprofitable by the billion-dollar quarterly profit standard the firm has been able to set for itself for much of the 1990s.

How about Bill?

IF THERE IS any uncertainty at all about the future of Silicon Valley, it is because of the huge, and ever-growing shadow which Microsoft is casting over the Valley.

To be sure, the fact that 95% of the world's personal computers are running on a single operating system has been a blessing of immeasurable proportions for the vast majority of companies in the Valley. It has opened the typical garage-type startups to markets with hundreds of millions of potential customers, an almost certain formula for creating ever more wildly successful Silicon Valley high-tech companies producing hardware, software and peripherals to serve an almost infinite market.

But Microsoft has also proven a dangerous and worrying force. Like a giant black hole, any type of relevant technological innovation is sucked up by the hugely powerful gravitational force emanating from Seattle. The best that companies with innovative technologies can hope for, is that Microsoft ends up buying them. More likely, Microsoft will put its legions of engineers to work to produce a similar technology and either launch it as a competing application — or worse, incorporate the gadget into its Windows OS, killing off companies and entire market segments in the process.

The US Congress and Justice Department are currently making a dramatic and brave stand in an attempt to bring Microsoft under some kind of control, which would prevent the firm from abusing its huge market power. The odds that anything will come of the legal action, that will affect Microsoft in any significant way, is highly unlikely. Anything that could be considered as little more than a slap on the wrist will mean victory for Microsoft and will give the firm the same leverage to do as it pleases as it enjoyed after the half-baked 1994 antitrust settlement.

And one last prediction, if I may. Ten years hence I believe Steve Jobs will still be an icon of the Silicon Valley culture, whether it be at Apple, at the helm of his animation film company, as a high-ranking state or national politician — or in some other capacity that will extend the seemingly improbable and amazing career with which this insanely great character has enlightened the world of personal computing since 1976.

The same, only more

TRYING TO MAKE specific predictions of how Silicon Valley and individual companies will develop over the next 10 years would largely prove an exercise in futility, as my last attempt 10 years ago clearly demonstrated.

The only certainty is that the past is due to repeat itself in Silicon Valley. And that means the unexpected rise of new crops of companies, the unveiling of critical new technologies and products, the dramatic demise of some of the Valley's stars, the lawsuits, the mergers, the personality clashes — and luckily for me, a never-ending stream of news reports detailing it all. ❖

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Reader Info No. 6

Forum

Conducted by Jim Rowe

Making it in Australia, EMFs and other health issues

I have a rather mixed bag for you this month. First, there's another response to my lament on the poor state of Australia's electronics manufacturing industry. Then there's an item concerned with the EMF-health risk issue, and finally a message from one of our regular contributors — with a challenge to proponents of 'subtle energy medicine'...

BACK IN the July 1998 issue, you may recall, I wrote a leader complaining about the lack of dynamism in Australia's electronics manufacturing industry. I'd just returned from a trip to the USA, visiting mainly semiconductor firms, and the contrast between here and there had really hit me again. I didn't write out of any naive hope that doing so would bring about a worthwhile improvement in the situation; it was more out of a desire to record my perception of our problem in this area, before I sank back into the forest and became unable to see the trees again. A kind of 'poor fella my country' scream of anguish, if you like...

Since then a few people have responded, and I've published them here in Forum. In the main, they've tended to be broadly sympathetic, while not necessarily coming up with any solutions. Now another of these responses has arrived, but taking a rather hard nosed — yet realistic — approach, and suggesting the real problem and the way it needs to be tackled. It makes interesting reading, so I thought we'd use it to kick off this month's column.

The writer is Mr Max Williams, and as he sent it by e-mail I can't determine his geographical location. But you'll find it's quite self-explanatory:

Your editorial on the state of the local electronics industry is a timely return to an issue of strategic importance to both our society and our economy. As we have come to expect, it is an issue on which the politicians cop a caning, and on which most of us lament the things that might have been.

I have a quite different view. I argue that we have the electronics industry we deserve, and that with effective management we can make it whatever we reasonably want it to be. In short, we have no-one but ourselves to blame for any present shortcomings.

My history in electronics begins when I was 10 or 12 years old, this magazine was called 'Radio and Hobbies', and I could only scrounge old editions from the bloke next door as long as I returned them when I'd finished. Later I qualified as an engineer, and reached the level of 'FIREE'.

There was palpable excitement in 1963 when, as part of a new cinema project, I developed a cinema sound system (was it the first commercial installation?) using a solid state sound head for an optical sound track. Despite the conventional industry wisdom that you 'can't get the fidelity with transistors', the system pushed the sound quality to the very limits of the medium. Almost all the components were made in Australia, and those were very exciting days. It was great to be a part of an indigenous electronics industry, and anything seemed possible.

Later, we all had to come to terms with the realisation that the industry protection of the McEwen era had harboured some very inefficient and unhealthy businesses. Then we had to come to terms with the 'slash and burn' philosophy of the Whitlam-inspired Industries Assistance Commission (some used the word 'Assassination'), which changed forever the local industry landscape. These parts of our history, along with current government policies, make up the ground rules under which we now operate. Successful industries have learned to work within those constraints.

In the mid 1980's we had some terrific technology companies, but regrettably most have fallen by the wayside. It is easy to blame the government, or someone else. It was about that time that I set up my own consulting firm to provide management and marketing consulting services to technology companies. In every case of a failed technology business I looked at, there had been fundamental management errors directly responsible for the demise of that company. By contrast, successful technology companies do operate in Australia even today, demonstrating that it can be done.

Although our practice targets technology companies, our client list includes interior decorators, swimming pool supply houses, printers, retailers, cosmetic manufacturers, and car accessory dealers, almost anything but technology businesses. One after another, we have found technical people so infatuated with their products and their own (technical) skills, that they expect success. Sadly, it often eludes them. Often we hear "But this is a technical business, those (management) rules don't apply here!" In fact, they do.

Such technocrats miss the point that in addition to the core competency of the business (the electronics skills the key people provide), a successful business needs professional management as well. Small Business Victoria has a brochure that illustrates the point beautifully.

We have dozens of 'war stories' that also illustrate that very point. Like one prospective client who said "Oh, my daughter has just finished a business course, and she will be doing that for us!" As you would expect, the company has since died.

When my son finished his medical course, he saved the life of an 80 year old lady, and nearly made a 20 year old man into a paraplegic in his first week in hospital residency. Thank goodness for the hospital supervision and experience that helped him learn without creating a tragedy!

Professional managers

If we would not trust our health to a newly qualified but inexperienced doctor, why would we trust the management of our businesses to people not both qualified and experienced to carry out the work? In hospitals, the business management is not handled by doctors and nurses who provide the core competencies, but by professionally skilled business managers.

To confirm the point, our client list does include one of the world's foremost automation companies. The quality of that management is in a totally different class from the others I have been referring to. The company is strong, and getting stronger because of the quality of their management. Their technical resources (their core competencies) are magnificent, but these are taken as a given, just one of the essentials you need in order to suc-

ceed. It is the quality of the professional management that makes the difference.

Such companies don't have these resources because they are big and successful, they are big and successful because they put in the properly qualified management resources they needed to succeed.

The time is ripe now for those of us dedicated to having a viable Australian technology sector to understand that the core competencies are not enough; to understand that business management is a tough call by itself, and that we need special skills in management to make the technology succeed. If we can enhance our infatuation with the technologies (the core competencies) by the application of professional management skills, there is nothing Australian ingenuity should fear.

If we marry good, professionally qualified technologists with good, professionally qualified managers, we can grow a great indigenous Australian electronics industry once more.

Thank you very much for those thoughtful — and thought provoking — comments, Mr Williams. Management skills certainly are crucial to the survival and success of *any* company, as you say, whether its business is 'technical' or not. I've seen this myself, in my own limited experience of commerce and hi-tech manufacturing industry. It doesn't matter how many hot-shot technical experts you have in an enterprise; if it doesn't have people at the top who are really skilled at management, it's pretty well doomed. Failure is only a matter of time...

As you say, this fact doesn't seem to have been well recognised or accepted in Australia, especially in our electronics industry. You're probably right that this is the main reason why we've lost so many electronics manufacturing firms, and also why we may not get too many more in the future.

I find myself wondering, though, why it is that good management *seems* to be so thin on the ground here — compared, say with the USA. Is this really so? Their industry and market are so much bigger than ours, after all, and I believe a fair number of their start-up hi-tech companies go broke too. Perhaps we're not really so bad, on a pro-rata basis.

I find it hard to believe that Australians are somehow less capable than Americans when it comes to management skills, don't you? If there *is* a difference, perhaps it's due to the relatively low regard in which skills like good management are held here, as opposed to the USA.

Of course even if we're no worse, on a pro-rata basis, I suspect that the relatively small number of skilled managers here can still provide a stumbling block to us developing a really viable and flourishing electronics industry again. This kind of hi-tech industry seems to have to achieve a kind of 'critical mass' before it really 'takes off', I think. Perhaps that's why few countries have achieved the same sort of dynamic as California's Silicon Valley.

Anyway, Mr Williams, thanks again for those interesting comments. It's nice to know that someone with your insights and experience found my leader worthy of comment.

EMF cancer report

Moving on, let's return to the thorny topic of electromagnetic fields (EMFs) and the growing evidence that they can contribute to cancers and other health problems, even in the relatively low 'non heating' energy densities associated with cellular phones and other modern electronic devices. As you would expect, I try to monitor the internet to keep an eye on what's happening in this area.

One thing I picked up a couple of weeks ago, on an e-mail posting, was a report by Dr Louis Slesin, highly respected editor of the US publication *Microwave News*. Dr Slesin and other US scientists have been fairly critical of their country's National Institute of Environmental Health Sciences (NIEHS), which seems to be most unwilling to recognise any possibility of a health risk associated with EMFs, despite the growing evidence. There's been a suggestion that they're in some way influenced by the big power and telecommunications firms, or at the very least unwilling to upset them by making pro-

nouncements which could impact upon profits... (Sound familiar?)

What seems to have prompted Dr Slesin to write on this occasion was the NIEHS response — or perhaps more accurately, its *lack* of an official response — to a report issued by one of its own working groups, which did suggest a possible link between EMFs and cancer. As you'll see, he felt this was too serious to allow them to sweep it under the carpet. Here's what he had to say, in a message titled 'NIEHS Ignores EMF Cancer Risk':

Everybody has been wondering how the National Institute of Environmental Health Sciences (NIEHS) would handle the designation, last summer, of EMFs as 'possible human carcinogens' by one of its own working groups. NIEHS' strategy became crystal clear on December 14: the NIEHS plans to ignore it.

At the last meeting of the National EMF Advisory Committee (NEMFAC), held jointly with the EMF Interagency Advisory Committee in Washington on December 14th, the NIEHS staff distributed a 352-page document, titled: 'EMF RAPID: Program Report'. This report, which details research results from studies sponsored by the NIEHS, neglects to even mention the conclusions of the NIEHS Working Group. It only states that the Working Group had issued its own report. Nor is there a single word about the three science review symposia that the NIEHS organized to prepare for the Working Group meeting held last June in Minneapolis.

*The report does specify that the NIEHS spent $2,569,064 to run the science symposia and the Working Group meeting — which is close to 10% of **all** the moneys spent on research by the NIEHS under the EMF RAPID program. Nevertheless, none of this work was seen as important enough of being included in NIEHS' own 'Program Report'.*

This is how the four authors of the NIEHS report — Drs. Gary Boorman, Michael Galvin, Christopher Portier and Mary Wolfe — began their overall conclusion:

'The results of the research supported by this program provide substantial evidence that there is not a robust biological effect of EMF exposure at environmentally relevant levels. These data when taken together with the National Academy of Sciences [NAS] report provide a basis for concluding that environmental EMF exposures at the levels to which human exposure occurs in the environment do not demonstrate an effect on critical biological processes and functions that could be expected to adversely affect human health....'

*Note that the NIEHS cites the NAS EMF report but not its own Working Group report — even though the latter is more recent, and Portier himself has said that the two reports are **not** inconsistent.*

The members of NEMFAC could not believe what the NIEHS was doing — and said so openly. It's "shocking" said NEMFAC Chair Shirley Linde. "Stunning," said Margaret Seminario of the AFL-CIO. And Dr Peter Bingham, who recently retired from Philips Electronics, commented that, "You would think we were in a different universe".

The December 14 meeting was surreal even by Washington standards. NIEHS' Portier, who had organized the Working Group meeting as well as the science review symposia, refused to say whether he stood behind the conclusions of the report, which bore his and Boorman's names. When asked directly whether he agreed with what was written, he replied "I have no comment". He then left the meeting.

When Congress established the EMF RAPID research program in 1992, it required that the Director of the NIEHS, Dr Kenneth Olden, report back at the end of the program on "the extent to which exposure to EMFs produced by the generation, transmission or use of electric energy affects human health".

Many of those at the meeting observed that Boorman's report could easily have been mistaken for Olden's report. After all, it was titled 'Program Report' and it included a cover letter from Olden, which began: "I am pleased to provide this report on the Electric and Magnetic Fields (EMF) research and communication activities that have been conducted over the past six years..."

But in fact, Olden's official report to Congress is separate and will be issued later. Portier stressed that the Boorman Program Report "does not reflect the overall conclusions of Dr Olden's report." But he and others from NIEHS declined to be specific as to what Olden will tell Congress.

Boorman's report, with its bright yellow cover, was given out with a rubber stamped 'DRAFT' in small type on the front cover. But that draft stamp seemed almost an afterthought. Most government reports that are still in draft form have the words 'draft: do not cite or quote' printed on the top of every page.

In response to NEMFAC criticism, Boorman said he would make some changes before issuing his report.

Last summer in its press release announcing the Working Group's decision to classify EMFs as possible carcinogens, the NIEHS included a quotation that if EMFs did in fact present a health risk, it would be a small one — even though the subject of risk assessment was never discussed by the Working Group. At the time, some observers suspected that the press release was an early indication of how NIEHS would try to bury the EMF question. The new Boorman report appears to confirm these suspicions.

*Portier said that NIEHS Director Olden will send **his** report to Congress sometime in February. At that time, it will also be released to the public.*

PS: I should note that I am a member of NEMFAC and I too was amazed by Boorman's brazen report.

PPS: The full text of the Working Group report is available on the Web at <www.niehs.nih.gov/emfrapid>.

Hmmm — as you can see, Dr Slesin has drawn attention to what seems like yet another attempt by NIEHS to pretend that there's no problem. It's all starting to sound very much like the cigarettes and lung cancer scenario all over again, isn't it?

Electrotherapy

Before we end up this month, let's consider another angle on the topic of 'subtle energy medicine'. It's been suggested by our regular contributor Jim Lawler, of Geilston Bay in Tasmania, who unfortunately now has a very personal and direct interest — as revealed in this e-mail from him last week:

I've been following the 'Electro-therapy' arguments in Forum with some amusement and scepticism. However, a recent occurrence has given me a much more personal interest in the subject.

Last week I suffered an attack of 'Bell's Palsy', a fairly rare (3-4 in 10,000 per annum) affliction that paralyses one side of the face. The symptoms are caused by damage to the 7th Facial Nerve, where it emerges through the skull just above the ear. At present, I cannot close my left eye nor control the left side of my mouth. Sensation is quite normal, with no sign of numbness, although taste is slightly affected. The most unpleasant symptoms are constant dribbling from the corner of the mouth, and 'Dry Eye' caused by the inability to raise the lower eyelid to seal the eye. This symptom can be minimised by wearing an 'eye patch', which with a twisted smile gives rise to a convincing Captain Hook appearance.

When I was first diagnosed with this affliction, my doctor suggested that I look up the subject on the Internet. When I did, I found hundreds of pages on the subject from researchers, medicos and patients around the world. Bell's Palsy might be a rare disease in any one community, but it is quite a large problem on a world-wide basis.

The official view of Bell's Palsy is (a) it is probably caused by a viral infection; (b) the affliction will run its course, and no treatment has been found to be effective; (c) recovery will take from six weeks to nine months; and (d) 75% of patients will recover completely, 20% will recover with only minor residual symptoms and 5% will retain significant symptoms.

Among the treatments tried have been surgery, accupuncture, chiropractic, physiotherapy, aromatherapy, massage, diathermy and various types of 'electro-therapy'. Of all

(Continued on page 75)

Serviceman

Bringing back the glow to the screen of a classic Tektronix CRO

This month we look at servicing jobs involving two 'historical' items. In these days of digital devices of almost every type, it's as well to remember that there's still a lot of worthwhile old analog stuff out there, just waiting for a spot of 'tender loving care'...

IN RECENT MONTHS, I've discussed many cases where worthwhile 'junque' was restored with minimal attention. This month I've got a similar story, but one involving much more sophisticated and valuable equipment. And it needed a lot more than 'minimal' work to get it going again.

The story comes from Eric Baynes, of Ferntree in Tasmania, and the equipment is a Tektronix type 564B oscilloscope, fitted with a four-channel vertical module and a split-screen analog storage CRT. This model of scope was near the top of the range when it was made, back about 1968-70. It is the sort of gear that would only be bought by University research departments or government agencies. In this case, it was the Tasmanian Hydro Electric Commission that purchased the scope, and as far as we can tell, it had very little use over the 15 years it was in service.

It seems that the Hydro made several attempts to repair the scope after it broke down, before giving up and stowing it away under a bench. By that time, of course, modern digital storage scopes were becoming available, so there was little incentive to restore the old Tektronix unit, even though it had been a major capital investment when it was first acquired.

Then recent moves to privatise the HEC led to a big clean-up in the various offices and laboratories, and the old Tektronix was brought out and tossed on the pile of junk to be auctioned off.

The old scope was offered in a job lot, along with a plug-in spectrum analyser and a delayed sweep timebase with matching tracking generator. Eric offered $300 for the lot and he was the successful bidder. (We believe the equipment had cost over $20,000 in 1970 money, when new! That was probably more than the Prime Minister's annual salary, in those days.) He carried the equipmemt home in triumph, although with the scope alone weighing in at 31-1/2 pounds (around 15 kg) it was no easy task.

It took Eric no time at all to work out that the scope was inoperative because the -3kV supply to the CRT cathode was not functioning. (As a matter of interest, most scopes have a negative EHT on the cathode, rather than a positive EHT on the anode as in TV sets. This simplifies the design of the vertical amplifiers since the deflection plates are at or near anode potential and the vertical amplifiers have to work at that voltage.)

Closer examination revealed that the EHT area was where the Hydro technician had been working. Most of the components in the high voltage generator had been removed and some had been replaced. But most telling of all, the EHT transformer had been removed and had not been soldered back into circuit.

Eric began enquiries about a new EHT transformer. The original service manual, which came with the scope, proclaimed that all coils and transformers in the instrument carried a 'lifetime' replacement warranty. However, the EHT transformer had obviously reached the end of *its* lifetime, since it was no longer available from the manufacturer.

(This left us wondering what is meant by a 'lifetime' warranty, since any of these components could have reached the end of their life within a week of being placed in service!)

So, with no chance of obtaining a new transformer, Eric began a search for an alternative part. His first 'port of call' was the Tektronix web site on the Internet. This produced a link to what might be called the 'Friends of Tektronix' newsgroup.

Here he found and made contact with Tektronix fans all over the world. He learned that as the owner of a 564B, he was the envy of enthusiasts everywhere. But no one could help him with a replacement transformer. When Eric asked about rewinding the unit, the response was "You can try, but — Good Luck!"

Well, he did try and, oddly, uncovered a possible reason for the original breakdown. Written in pencil, on an inside surface of the transformer core, was the notation 'bad waveform'. It seems the item had been less than perfect when first manufactured.

Anyway, Eric was unsuccessful with his rewind, since the windings were potted in epoxy and could not be dismantled. So his attention turned to a possible alternative: an EHT transformer from an old black and white television.

This idea didn't work out since the circuit arrangements in the CRO were totally unlike those in the TV. Specifically, the CRO circuit was essentially a self-oscillating power supply. Not really a switch-mode supply, since the drive waveform was a sine wave, but based on the same principle. The TV transformer, on the other hand, was a flyback design and the core ferrite was totally unsuitable for the CRO application.

"The EHT transformer had obviously reached the end of its lifetime, since it was no longer available from the manufacturer..."

All of the above work had taken place over six months or so, and Eric began to lose patience with the job. He pushed it under the bench and went on with other work.

At about the time he bought the CRO, he had also bought a couple of old photocopying machines. The intention was to strip them for their motors, gears and parts of their elaborate optical systems. However, other tasks occupied his attention and the machines sat in his garage for close to a year.

Then one day, when he was in 'clean-up' mode, he began to strip the machines, preparatory to dumping the carcases. As he worked through the electrical and electronic systems in the old machines, he came across a small black box linked to one end of the corona strip. (The 'corona' in copying machine carries a high voltage to impose a static charge on the paper as it passes through the machine.) The high voltage application immediately attracted Eric's attention, and he wondered which polarity it might be.

By the greatest of good fortune, it turned out to be negative, the same as the Tektronix CRO. It was also in the same general voltage region, around 3-4kV. He could hardly wait to try it out.

The copying machine EHT generator was somewhat smaller than the original transformer and fitted easily into the space available in the CRO. It was also powered by a similar supply rail, so there was no trouble getting it running. But it was at this point that the whole exercise came to a shuddering halt.

It seems that the CRO had not one, but *two* 3kV supplies. One was a simple half-wave rectifier feeding the grid of the tube. The other used an identical winding, but with the earthy end returned to a +100V rail via a front panel pot. This allowed the grid-cathode voltage to be varied by up to 100V, forming the brightness control for the screen trace.

Without the split winding, there was no way to apply a suitable bias to the tube and it ran at full brightness all the time. Eric even tried using two copying machine supplies, but although they were well stabilised, they could not be synchronised and it was impossible to keep them set to the required voltage difference.

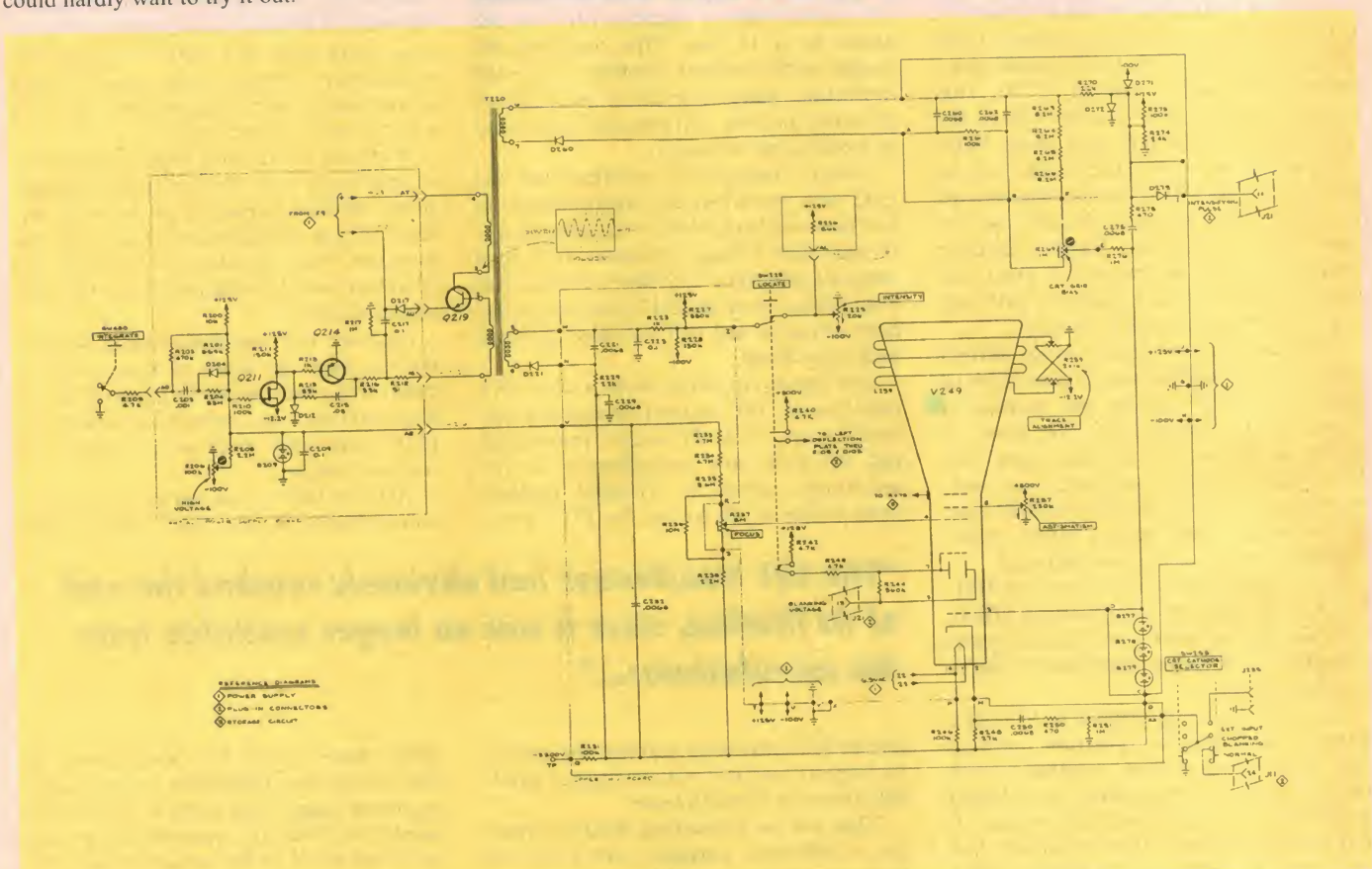
What followed required a degree of inspired experimentation. In short, he arranged to 'float' the 3kV supply, without a connection to ground. This permitted a limited control over the brightness by varying the 3kV to ground rather than the grid-cathode voltage.

I'm assured that the system works and the CRO is almost as good as new. It seems that brightness range is adequate, but cannot be turned right off. So the instrument has to be left in the AC trigger mode to prevent a screen burn when left running for any length of time. But that seems a small price to pay for the four channel, dual screen storage 25MHz oscilloscope.

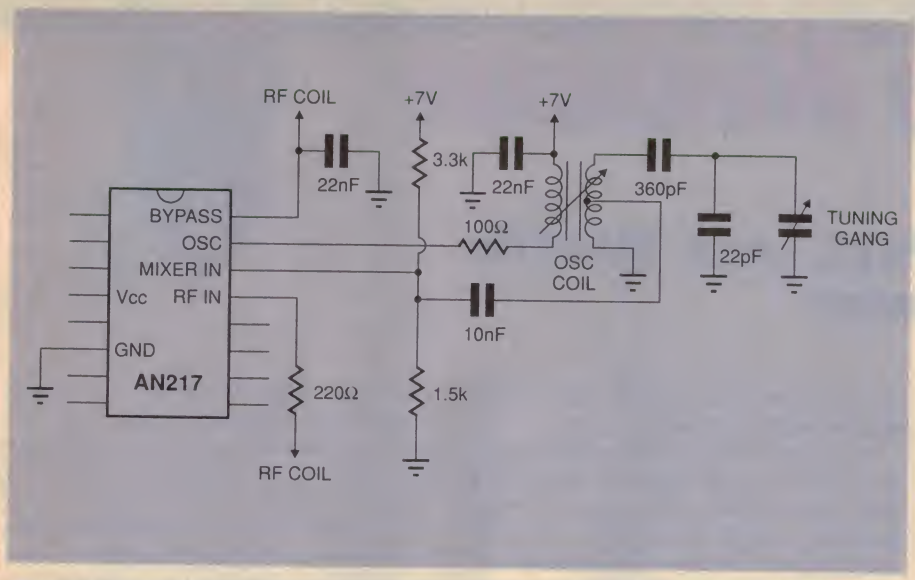
Eric has now advised his solution to the problem to friends on the Internet and has told me the story so that readers of the Serviceman column can share the knowledge.

These high voltage generators from copying machines are remarkable little devices. They produce a stabilised EHT from a low voltage input. They occupy very little space. And with thousands of old copiers now ending up on the tip, there is no shortage of EHT generators available for repairs, new designs or simply experimentation.

Footnote: Eric has since advised that he has repaired two other top-end CROs with similar faults, using the same technique. Now I wonder if one of these EHT generators could be used to replace a missing focus voltage in a colour TV?



The EHT power supply and CRT circuitry for Eric Baynes' old Tektronix 564B storage scope. The EHT supply's transformer had failed, and rewinding proved unsuccessful — but Eric found an elegant alternative to solve the problem...



The AM local oscillator circuitry in Keith Gooley's old Rank Arena AM/FM radio/cassette/record player. Was the fault in the AN217 chip, or in the oscillator coil?

Silent AM band

Next we come to our second story for this month, and it's from Keith Gooley of One Tree Hill in South Australia. Keith's 'Historical Item' is nowhere near as elaborate nor valuable as Eric's CRO, but it is still a very worthwhile project. And the fault that it suffered is one that's not all that uncommon. Here's what Keith has to say...

This story has a lesson in it which I think will be familiar to most regular readers of this column: test all the simpler components first, before jumping in to replace an IC or other complex part.

The fault occurred in an AM-FM radio cassette and record player unit made before the era of the 'ghetto blaster'. It had a dud audio section when it was given to me and after fixing that, I used the radio section in the shed, principally to listen to the Goons on ABC Radio National.

It had done sterling service in this role, in the dusty environment of my shed, for five years or so until the AM section started to fail a few minutes after switch-on. The FM section continued to work as well as ever.

Taking off the timber cover of the unit gives good accessibility to the 'works' — several printed circuit boards fixed to the masonite base. Access to the bottom of the PCBs is also reasonably good, with cut-outs in the base allowing the copper side of the boards to be examined. I have no circuit of the unit and the only information I have is that it is a Rank Arena; no model designation visible.

With the unit switched to AM, there was some noise from the speaker when the volume pot was turned up, but a complete absence of any signals, indicating that probably the IF and detector were working and that something had gone in the oscillator or mixer section.

The tuning gang is an open type with three small sections for FM and two much larger ones for AM. That the fault was in the local oscillator section was quickly confirmed when I put a CRO probe on the AM oscillator section of the tuning gang. There was no signal at all...

The FM front end is composed of discrete components on one side of the tuning gang while on the other is a 16-pin IC (AN217) which contains the local oscillator, mixer and IF for AM, and the IF and detector for the FM band. I was able to ascertain the pin connections to this chip from a reference book, and a bit of tracing of PCB tracks revealed the oscillator circuit.

The oscillator section of the tuning gang was connected to the PCB with a short piece of wire, so I first disconnected this and checked the tuning capacitor for a short. This seemed unlikely, but it was easy to remove the capacitor from the list of suspect components.

I then tested each of the resistors in the vicinity. All were close enough to their stated value. Capacitors in the oscillator tuning section tested open circuit with an ohmmeter and I removed two of them and measured their value on a capacitance meter. Both were OK.

The continuity of what appeared to be the oscillator coil had also tested OK. This is a miniature component 5mm square, with five pins. Unfortunately this was one component which was not easily accessible from underneath, as it was near the edge of the board and the cut-out in the base does not extend right to the edge of the PCB.

From the tests I could make, I concluded that the oscillator coil was OK; it was rapidly appearing as if I was going to have to replace the IC. So I ordered a replacement.

It duly arrived a few days later, and was quickly fitted. I didn't bother to replace the tin-plate shields over the top and bottom of the IC before testing the receiver, but the result was the same as before, no oscillator signal at all. So at least it wasn't intermittent!

In my haste to condemn the IC, I had not realised that the other pins on the oscillator coil appeared to be used for something and I could not measure continuity with an ohmmeter between the apparently extra pins.

It was a bit trying to get the oscillator coil out, due to the lack of access to this part of the PCB. But it was easier than removing the board altogether, as this would have meant restringing the dial. I had done that task before on this unit, and had no wish to repeat the rather fiddly exercise.

The coil itself pulled out of its shielding can easily and sure enough, one winding was open. So what to do now? There didn't seem much likelihood of getting a replacement...

At 51, I am at an age when there is a definite need for those magnifying glasses sold by the electronic retailers — and I certainly needed them to see any detail of this 5mm square coil. I had a poke with a sharp probe at one end of the faulty winding, and to my surprise and delight the fine copper wire lifted away completely from the coil base pin.

Another piece of good luck came when I tried to tin the broken end. The solder took to the enamelled wire quite easily. Thank goodness for self-fluxing enamelled copper wire! I was able to solder a short length of fine tinned copper wire to the broken end and terminate it on the base pin.

With the repair complete, I soldered the coil back in the board and the rest is history. The set came alive immediately without any need for retuning, though I did check the positions of the local stations on the dial.

Just out of interest, I put the CRO probe on the oscillator section of the tuning gang and was surprised at how high the oscillator signal level was. Some tens of volts peak to peak.

So, I've had the lesson again. Check the simple things first, before jumping to the conclusion that the most complex is at fault.

Since the earliest days of radio, open circuit oscillator coils have been only slightly ahead of O/C IF coils as a prime source of failure in domestic sets. Keith's story duplicates my experience of a hundred similar jobs over the years, except for his good fortune in finding a coil with self-fluxing wire. I have always had trouble scraping varnish from near-invisible wires, and my ancient eyes now find it almost impossible.

Thanks for that tale, Keith. Long may your 'genuine cardboard radio with leather ear trumpet' continue to bring you your weekly dose of 'The Goons'...

And that, I'm afraid to say, is yer lot for the month — to quote another popular ABC personality. I'll be back next month, weather permitting. ❖

Moffat's Madhouse

Meet Perfect Paul, your Electric Weather Presenter

THERE'S A GREAT service here in the USA that must come to Australia sooner or later, if it hasn't already. It's called NOAA Weather Radio. NOAA, for National Oceanic and Atmospheric Administration, oversees the National Weather Service — the US Weather Bureau.

The NOAA Weather Radio system consists of a large number of FM transmitters operating near the 156MHz marine band. Just about everyone in the US, and in US coastal waters, is within range of NOAA Weather Radio, and you can buy cheap receivers at places like Radio Shack to listen to the broadcasts. A similar system exists in Canada.

Weather Radio transmits a series of recorded weather forecasts, covering your local area, regions, the whole state, mountain areas and coastal waters. Each individual forecast section is written and then recorded on an endless tape cartridge by a weather bureau employee. The carts are plugged into a series of tape players, and then a machine sequences through each one. The whole cycle takes about five minutes and then repeats, so it's likely that within five minutes of tuning in, you'll hear what you want to know.

I can receive three of these Weather Radio stations from my home in Port Townsend — one on a mountaintop near Seattle, another from a hill closer to home which covers the waters of Puget Sound, and a third at Victoria BC, in Canada. Each forecast section is read by a different person — first a man, then a woman, then a man, and so on. All these transmissions are pleasant and easy to listen to. The announcers have a nice laid-back style, and if there are any grumpiness or hangover problems, you'd never know it from the sound.

In recent years there's been an enhancement to NOAA Weather Radio, called the EAS — Emergency Alert System. This comes into play when truly foul weather is coming your way, such as a tornado or a cyclone. Weather bureau people can command the system to send out a tone sequence to wake up everyone's weather radios even when they are turned off. Then comes a special data string that produces a written weather warning on specially equipped receivers. Finally there's a weather bureau meteorologist, announcing the imminent arrival of dangerous weather, along with a possible order to evacuate the area.

Not everyone has a weather radio receiver; in fact very few people do. Most don't even know weather radio exists. So radio broadcast stations now have a receiver which listens to NOAA Weather Radio, and when an EAS alert comes along, it rings alarm bells and prints out the weather warning for the station's announcer to read on air. A further option lets the EAS receiver break right in on top of the current program, taking control of the radio station's transmitter and broadcasting the weather alert as read by the weather bureau announcer.

This system gets a lot of use in the USA right now, what with El Niño effects and even worse storms brought about by global warming. Radio stations usually have their own announcer read EAS alerts during the day, but many stations are automated during the night, so the automatic takeover option is given full reign. Sometimes station executives growl about the quality of the weather bureau announcer's voice. But it's better than nothing, so they turn a deaf ear to it.

> ***"A lot of research has gone into Perfect Paul, but there are some fundamental problems — the worst of which is that he ain't human"***

CRS upgrade

With the stage thus set, permit me to introduce Perfect Paul, the new voice of NOAA Weather Radio. Time marches on, things get 'upgraded', and Perfect Paul is an integral part of the CRS — the Console Replacement System (don't those government bods love their acronyms!). Under the CRS, the microphones go, the tape cartridge players go, and all that remains are computer keyboards and screens. Human weather presenters are gone; their forecasts are typed into the computer by meteorologists, and then read by — a speech synthesizer!

A lot of research has gone into Perfect Paul, but there are some fundamental problems — the worst of which is that he ain't human. His male voice sounds like a sci-fi robot, and when he's being a woman he sounds like Donald Duck. Many radio station executives are furious. The chief engineer and station manager of WYPL in Memphis declared, "I'm not putting that voice on air!" He said every station in his area had removed the EAS capability from their NOAA Weather Radio receivers. One station even held a little on-air ceremony, formally cutting the wire.

Most of us decry the replacement of people by computers, but this issue goes a little deeper. The head of emergency communications in the state of New York fears the public might not trust Perfect Paul. "I think you need a human voice to tell you of a life-or-death situation", he says.

As Perfect Paul now stands, his voice comes from a DECtalk card, made by the Digital Electronic Corporation. Many readers would have heard a DECtalk in action; it's the same voice used by Professor Steven Hawking. Although Professor Hawking has no voice of his own, he conducts complex lectures and TV programs using his DECtalk card. But sometimes it's a little hard to follow him, and if you stop to decipher one difficult word and the DECtalk keeps going, you may lose it altogether.

DECtalk is a system using phonemes — speech sounds strung together under commands from a text-to-speech synthesizer which is following keyboard input. Since it is not limited by whole words, a phoneme system will have a go at pronouncing everything, even in a different language. Trouble is, if the language is English, it sometimes sounds like a foreign language.

Another common way of producing computer speech is via a 'concatenated' system, in which entire words are recorded by a human reader, then digitized, and stored in read-only memory. The computer then strings whole words together, producing

speech that at least started out as human.

One of the better concatenated systems was the DigiTalker made by National Semiconductor back in the 80s. I got involved with the DigiTalker while designing talking educational robots for the Flexible Systems company in Hobart. The DigiTalker, as I remember, had around 170 words digitized into two ROM chips. The interface to a computer was via an 8-bit bus, along with some handshaking lines, very much like the Centronics printer interface used in every PC computer today.

To make the DigiTalker speak, you sent it a word number on the data bus. This caused a busy line to go high for the duration of that word. The computer was programmed to wait for the busy line to go low again, and then send the next word number. So the DigiTalker could string together a series of words to make a sentence, with proper timing between the words.

We sometimes programmed the robots to roll around on the floor, yelling "DANGER!" whenever they ran into anything. They had collision sensors, so you could teach them to find their way out of mazes or follow walls. They'd say LEFT or RIGHT or BACK or FORWARD as they moved about, mixed with plenty of DANGERs. The kids loved them.

Within the limits of its vocabulary, a concatenated speech synthesizer can sound fairly good, since its words were originally spoken rather than synthesized. You would think it would be a simple matter to load a DigiTalker with words like rain, snow, temperature, frost, hot, and so on, and then it could read a weather forecast. It could certainly say WHAT all right, but the problem is WHERE the weather is to occur. There are many thousands of place names in the USA — towns, rivers, mountains, bays — all the places where a knowledge of forthcoming weather is important.

It would be possible to digitize the names of all these places. In one commercial software package designed to generate EAS alerts, there is a concatenated speech system with 3800 words. One announcer recorded the whole library in a day. But then consider what happens if you want to add more words to such a database some time down the track, and the person who originally recorded it is no longer around. Then you have to start all over again, from square one.

So it looks like a phoneme-based speech synthesizer is the only solution, at least for the National Weather Service which must cover a whole continent full of place names. There will certainly be problems though, since the same spelled word is pronounced

A NOAA Weather Radio station console...

differently in different places. For instance, there is a Beauford in South Carolina, and another Beaufort in North Carolina. They are on opposite sides on the state border in the same weather district. Yet one is pronounced "Bewfort" and the other is "Bowfort". In Virginia there is a town called Galax, as in galaxy, but it's pronounced "Gaylax". Oh dear, what's a poor speech synthesizer to do? It's possible to enter phonemes directly into most speech synthesizers, so maybe there will be custom versions of text-to-speech software for these areas.

I've heard Perfect Paul doing his stuff, and you can too; see the end of the end of this article. My impression is that Paul is not necessarily the best speaker for the purpose.

Back in the 80s I did a lot of work with speech synthesizers, including the development of a kit called 'Chatterbox' for the old *Electronics Today* magazine. It was based on the Votrax SC-01 chip, driven by an 8-bit port in a computer. There was no text-to-speech software, only direct entry of phonemes. You picked one from a list, tried it, and if not exactly right, tried another. You could string the phonemes together to form quite reasonable speech.

One memorable application for Chatterbox was with a Microbee computer, along with two turtle educational robots — a boy robot and a girl robot. At an engineering show in Melbourne, the two robots got a little carried away with each other, resulting in speech synthesizer lines such as "Oh Bertie, will you still love me in the morning?". People witnessing this event had no trouble at all understanding what the Chatterbox was saying.

The Votrax SC-01 was somewhat bland, with no attempt at inflection. It just rattled off the words. A later development was the SC-02, which required up to five bytes of data for each phoneme, rather than one as the SC-01 required. This brought in pitch, inflection, pacing, even something approaching emotion if you were clever enough at picking and configuring the phonemes. As I remember it sounded somewhat better than Perfect Paul, although there was a lot of work required to get each sound out of it.

Another interesting development was a gadget I saw at another engineering show. Memory is a bit sketchy here, but I think this speech synthesizer was made by Digital Equipment (known as DEC in those days), and the chip inside it was by Motorola. This device could babble away quite convincingly, and even sing to you from time to time. Very impressive, but I never heard of it entering the commercial marketplace.

A real sleeper in the synthesizer stakes was not a chip at all — just a software program driving a computer's internal speaker. The computer was an Apple II, and the program was called SAM, for Software Automatic Mouth. The demo files that came with SAM could recite a pretty convincing version of the American Declaration of Independence, as well as some of Shakespeare's soliloquies.

This was one very classy software package, until we corrupted it. SAM was the voice of Elami, a big robot that was hired out to shows and other events around Hobart. You could roll him out under remote control, and then make SAM say "Ladies and gentlemen, permit me to introduce today's speaker". Pretty impressive, until we used some of Elami's other features later on. If the speaker was a politician, Elami would wait until he made some dubious promises and then bellow "Ha, Ha, HA!". Later, during drinkies after the speech, Elami would emit a thundering BURP, again courtesy SAM.

That was probably 15 years ago. You'd think with all the advances in technology, Something like SAM could be developed, entirely in software, with a custom version for each location, containing all those local place names.

Something will need to be done, because the way things stand now, there's no way American radio stations are going to accept Perfect Paul. The NWS is aware of this, and it's still allowing real live people to read out weather reports where staffing levels permit. But later on, who knows?

Now's your chance to hear Perfect Paul in action. Log onto Electronics Australia's web site (**http://www.electronicsaustralia.com.au**), go to the Free Downloads/General Files page, and click on the file called PERFPAUL.WAV. This should make your browser download the file, and then bring up whatever application is needed to let Perfect Paul reel off various weather phrases. See if you agree with the irate radio station execs. Can YOU understand Perfect Paul? ❖

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NEW MEM

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NEW MEM

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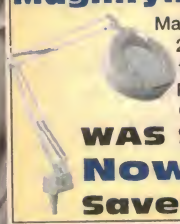

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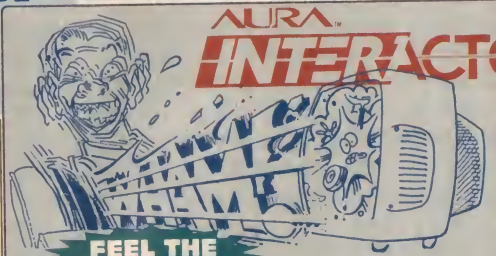
OVERNIGHT DELIVERY

AURA INTERACTOR BODY BLASTERS CUSHION



FEEL THE ACTION

SAVE $200

MARCH $49.95

We have made a huge distress stock purchase from AURA in USA. We have sold thousands of the Interactor Backpacks, and now can offer a CUSHION VERSION, for a crazy low price. The cushion should sell for well over $200, but you can grab one - or more, for only $49.95 each, while stock lasts. THEY ARE WELL UNDER 1/2 PRICE! This Interactor Cushion will transform low sounds into movement, so you can actually feel these through your back. Simply place in your lounge chair, or seat, and complete a 3D sound environment for added impact for home theatre, computer games etc. The Interactor Cushion can be used with almost any PC/Mac, home theatre system, CD player or video. Supplied with black cushion (with inbuilt shaker), amplifier module, 240V mains power supply and connecting lead set.

Cat. XC-1005

BACKPACK

Plug it into computer games, stereos etc, then put the back pack on and feel all the low frequency sounds. See 98 Cat. page 213 for full details. SAVE $200

MARCH $39.95

Cat. XC-1000

AURA ADAPTOR CABLE FOR N64 & PLAYSTATION

This pack contains all the leads required to attach the Aura Interactor Backpack to your games console and stereo system. Includes RCA piggyback lead, 3.5mm phone to 2 x RCA adaptor lead, RCA joiners & stereo Hi Fi RCA cable. Total value $17.40.

Cat. XC-1001 **$9.95**

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

Deluxe Punch-Down Tool - Adjustable

This deluxe punch-down tool has features to achieve the perfect 'punch' for different wire sizes. It has a turnable body, adjustable impact pressure & a storage compartment within the handle for holding a spare blade. Not supplied with blades see TH-1742 & TH-1743 below. Cat. TH-1740

NEW MEM

$69.95

Punch-Down Tool / Stripper - Low-Cost

This versatile little tool will strip wire up to 5-6mm, and doubles as a punch-down tool for 110/88-type terminals. Made from poly-resin plastic, with steel cutters this lightweight tool could easily fit in the pocket, or tool-kit. Cat. TH-1738

NEW MEM

$6.95

Punch-Down Tool

Designed for seating wire into terminal blocks. Has internal impact mechanism. Not supplied with blades see TH-1742 & TH-1743 below. Cat. TH-1741

NEW MEM

$29.95

Blades for Punch Tools

These blades are to suit both the punch tools above - TH-1740 & TH-1741, these blades are both changeable and reversible, and can be changed by hand - no screwdriver necessary. One end of each blade has a cutter for that extra-neat termination, the other end is plain for those "linked" blocks.

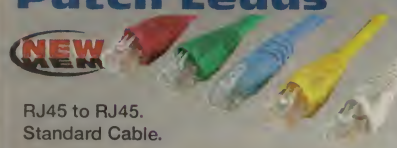
Cat. TH-1742 110 / 88 Blade for Punch Tool
Cat. TH-1743 Krone Blade for Punch Tool

NEW MEM

$19.95 each

CAT 5 ACCESSORIES

Patch Leads



NEW MEM

RJ45 to RJ45. Standard Cable.

Colour	Length	Cat	Price
Blue	0.5 m	YN-8100	$5.95
Blue	1 m	YN-8101	$7.50
Blue	2 m	YN-8102	$9.95
Blue	3 m	YN-8103	$11.95
Blue	5 m	YN-8104	$14.95
Red	0.5m	YN-8110	$5.95
Red	1m	YN-8111	$7.50
Red	2 m	YN-8112	$9.95
Red	3 m	YN-8113	$11.95
Red	5 m	YN-8114	$14.95
Yellow	0.5 m	YN-8120	$5.95
Yellow	1 m	YN-8121	$7.50
Yellow	2 m	YN-8122	$9.95
Yellow	3 m	YN-8123	$11.95
Yellow	5 m	YN-8124	$14.95
Green	0.5 m	YN-8130	$5.95
Green	1 m	YN-8131	$7.50
Green	2 m	YN-8132	$9.95
Green	3 m	YN-8133	$11.95
Green	5 m	YN-8134	$14.95
Grey	0.5 m	YN-8140	$5.95
Grey	1 m	YN-8141	$7.50
Grey	2 m	YN-8142	$9.95
Grey	3 m	YN-8143	$11.95
Grey	5 m	YN-8144	$14.95

Cat 5 Patch Panels

Has 110D terminal blocks, can be used for both Krone and 110 impact tools, and has combined T568A and T568B colour coding. Black in colour, top entry type and 19" rack mounting. Cat 5 certified. Size 478(L) x 43(H) x 32(D)mm.

NEW MEM

12 PORT Cat. YN-8040 **$169**

24 PORT Cat. YN-8042 **$225**

Keystone Flush Plates

Fit standard Australian wall fittings. White in colour.

SINGLE PORT Cat. YN-8010 **$2.95**

DOUBLE PORT Cat. YN-8012 **$2.95**

TRIPLE PORT Cat. YN-8014 **$2.95**

NEW MEM

110 Keystone Jacks

Suits plates and boxes. White in colour. Cat. YN-8030

NEW MEM

$8.95

Keystone Surface Boxes

Side entry to accept standard Keystone 110 jacks. Colour white.

NEW MEM

SINGLE PORT Cat. YN-8022 **$3.95**

DOUBLE PORT Cat. YN-8024 **$4.50**

CAT 5 UTP SPLITTER

RJ45 plug to 2 x RJ45 sockets. Accommodates 2 services over the one cable. Typically a single 4 wire telephone & a standard Ethenet computer, or 2 PC's can be used over 1 cable. Standard wiring. Length 150mm.

Cat. YT-6090 **Only $16.95**

Thermal Circuit Breaker/Switch

AUTOMATIC RESETTING
BI-METALLIC DISC, SNAP ACTING

NEW MEM

This phenolic-housed unit attaches to any metal surface. When that surface meets or exceeds a certain temp, the SPST bi-metallic element goes open circuit.

ST-3821 50°C ST-3825 90°C
ST-3823 70°C ST-3826 100°C

$4.25ea

2.0uf 250VDC Cap

Our normal price for these is $2.25 each. We've made a bulk surplus deal, and can offer these at well below normal price. They are white in colour, size 31(L) x 10.5(W) x 20(H)mm. Lead spacing 27mm, lead length 18mm.

NEW MEM

Cat. RG-5176 Pkt 10 **$7.95** Cat. RG-5177 Pkt 100 **$59**

Panel Mount Thermal Circuit Breaker (CBE)

Snap in fitting with coloured button.

SF-2293	3A AC
SF-2295	5A AC
SF-2297	7A AC
SF-2300	10A AC
SF-2315	15A AC

NEW MEM

$6.75 ea

Flat Cable Suppression Sleeve

For 16 way cable. See Cat. page 138 for full details. Cat. LF-1280

Was $3 pkt 2 Save $2

March $1 pkt of 2

TRANSFORMER BARGAIN

Secondary voltages at 0, 12, 15(CT), 24, 27, 30 @ 4A. Limited quantity available. Cat. MM-2009

Cat. Price $45

Sellout $30

Save $15!!

91 Element UHF TV Antenna

Covers bands four and five. Gain 15 - 19dB. Cat. LT-3182

Was $79.95

March $59.95

Save $20

6P/4C WALL SOCKET

NEW MEM

Square wall socket to suit 6P/4C RJ12 plugs. Screw terminals for connection. Size 44 x 44 x 24(D)mm. Limited quantity. Approved. Special price. Cat. YT-6059

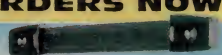
only $3.95

EMAIL ORDERS

mailorders@ jaycar.com.au

EMAIL YOUR ORDERS NOW

STRAP HANDLE



Was $5.50 March $3.50ea Buy 10 $3ea HS-8022

MICRON SOLDER STATION TIP SELLOUT

Suits our old Micron TS-1580 station. See 98 Cat. page 112. Limited quantity.

1MM ROUND Cat. TS-1461 **STOCK UP!!!**
1.5MM ROUND Cat. TS-1462

Were $14.95ea. Sellout $6.95ea.

Toroidal Bargains

30 + 30V 300VA Cat. MT-2136
50 + 50V 300VA Cat. MT-2144

Were $74.95ea

Now $50ea Save $24.95

Testing Loudspeakers by Joseph D'Appolito

Chapter headings include:-
•2-Driver testing •3-Low frequency system electrical impedance tests •4-Acoustical testing of single drivers •5-Acoustical testing of multiple - driver systems •6- Time, frequency and the Fourier Transform •7-Loudspeaker testing with PC based acoustic data acquisition systems. This book was reviewed in Speaker Building Magazine No.6, 1998. These are exerpts from the review: "The book fills a real void in technical literature and is packed with useful information. Chapter 2 alone is worth the price of the book. If you are seriously interested in loudspeaker testing. Order a copy." Softcover 280 x 215mm. 174 pages.

NEW MEM

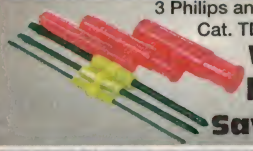
Cat. BA-1420

Only $69.95

OVERNIGHT DELIVERY

OVERNIGHT DELIVERY

3 PCE REVERSABLE SCREWDRIVER SET

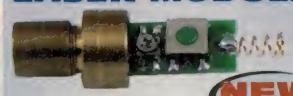


3 Philips and 3 slotted.
Cat. TD-2023
Was $9.95
Now $6
Save $3.95

Instrument Case

Large vented case. Used in many kits. Size 260(W) x 190(D) x 80(H)mm. Cat. HB-5910
Was $19.95 Save $4.95
March $15

LASER MODULE



NEW MEM

Ideal for experimentors. Includes laser diode mounted on a PCB with a battery spring and on/off switch. Simply connect a 3V battery - negative to spring, positive to case, and you have an experimentrrs laser. 1mw output. Cat. ST-3115
$14.95

DON'T FORGET TO VISIT OUR WEB SITE:
www.jaycar.com.au

Terminal Strip Madness

Large 30 amp, 12 way. Size 153(L) x 23(W) x 20(H)mm. Cable size entry 5.6mm dia. Cat. HM-3198
Normally $2.25ea
MARCH SPECIALS
Buy 1 $2ea
Buy 10 $1.50ea
Buy 100 $1.20ea

PCB Mount Thermal Circuit Breaker (SPST)

Miniature auto-resetting thermal type units that solder directly into a PCB. Ideal for protecting power supplies, amplifier output transistors,appliances.

Cat. No.	Contact Rating	Contact Resistance
SF-2281	1.5A	0.12 ohm
SF-2283	3A	0.075 ohm
SF-2284	4A	0.050 ohm
SF-2285	5A	0.050 ohm

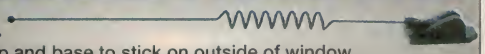
NEW MEM

$5.95 each

Motor/Gearbox Kit

This gearbox enables you to simply create a gearbox with the following ratios, 4:1, 15:1, 64:1, 256:1, 1024:1 and 4096:1. This equates to 3379, 845, 211, 53, 13.2 & 3.3 RPM at a motor speed of 3VDC (note motor is supplied). See 98 Cat. P 212 for details. Cat. YG-2715
Was $22.95 **Save $5**
March $17.95

Car Cellular Phone Whip

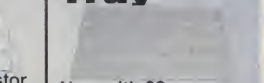


Ideal replacement.
Includes whip and base to stick on outside of window.
Cat. DC-4050
Was $9.95 **March $6.50** **Save $3.45**

FREE CALL FOR PHONE ORDERS
1800 022 888

COMPONENT STORAGE TRAYS

Capacitor Tray

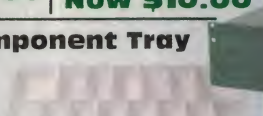


Matches the resistor tray . Its the same physical size, but has 45 larger sized compartments, each measuring about 25 x 83mm. Ideal for capacitors, plugs etc. Cat. HB-6344
Now $10.00

Resistor Tray

Now with 88 Compartments! Enough to hold one of our RR-1697 resistor packs (10 of every 1/4W from 1 ohm to 10M) Size 420(L) x 275(W) x 13(D)mm. Cat. HB-6342
Now $10.00

Large Component Tray



The third in a series. It has15 large storage compartments & is 34mm deep. Compartments measure 130mm long, and are 11x45mm wide, 2x55mm & 2x78mm. Cat HB-6343
Now $10.00

March Special $10 ea Save $1.95

Magnetic Metal Dish

Holds small parts magnetically. Cat. TH-1970
Was $10.95
Save $4
March $6.95

SPEAKER STANDS

600mm high, black painted steel. See 98 Cat. page 48. Cat. CW-2845
Were $89.95 Pr
March $69.95 Pr
Save $20

AUDIO GENERATOR

See 98 Cat. page 31 for full details. Cat. QT-2300
Normally $269
Save $40
March $229

Nashua Gaffer Tape

40 metre rolls high quality tape. 50mm wide. Colour black.
March $20
Roll Cat. NM-2812
Save $2.50

ARTWORK KNIFE AND BLADES

STOCK UP!!!

KNIFE
Normally $3.99ea.
March 5 for $12
Save $7.95 Cat. HG-9955

BLADES - Packet 5
Normally $2.99 Pkt
March 5 Pkts for $10
Save $4.95 Cat. HG-9956

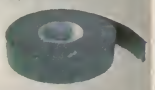
NEW RACK CABINETS

NEW MEM

44MM BLACK
Cat. HB-5410
$69.95

88MM BLACK
Cat. HB-5412
$87.95

Self Amalgamating Adhesive Tape



This tape is an adhesive synthetic rubber and resin based tape that "cures" to a single mass once it is taped. Its ideal for sealing, waterproofing and insulating. Roll size is 20mm wide x 5mtrs. long. Black in colour.
Cat. NM-2826 **$19.95**

T Case Bargain

High quality instrument case. Grey in colour. 230(H) x 120(W) x 90(D)mm.
Limited qty at this price.
Was $24.95
Save $10
March $14.95
Cat. HB-6514

Holding Clips

PKT. 4 Holds things while soldering. See 98 Cat. page 122. Cat. HM-3090
Was $3.95 Pkt 4
March $1.95 Pkt 4

16 DRAWER PARTS CABINET

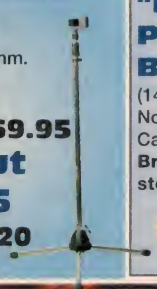
Was $14.95
March $12.95
Save $2 Cat. HB-6320

Jaycar LOUDSPEAKERS 10" Instrument Speaker

Power handling 65WRMS. See 98 Cat. page 38 for full details.

Was $62.95
March $49.95
Save $13 Cat. CG-2376

Telescopic Mic Floor Stand



Adjustable from 900 to 1600mm. See 98 Cat. page 203. Cat. AM-4140
Was $69.95
Sellout
$49.95
Save $20

5" Shielded Woofer

Ideal for centre speakers. Twin voice coils. 20WRMS power handling. See Cat P41
Was $49.95ea
March $39.95ea
Save $10 Cat. CW-2102
MAGNETIC SCREENED

RESPONSE 4Ω Dome Tweeter

See 98 Cat. page 59 for details.
Was $24.95
March $20
Save $4.95 Cat. CS-2212

GENUINE MOTOROLA "BRICK" CELLULAR PHONE CHARGING BASE/AC ADAPTOR

(14.5VDC 710mA) Limited quantity. Not at Dealers. Cat. MP-3150
Brand new stock

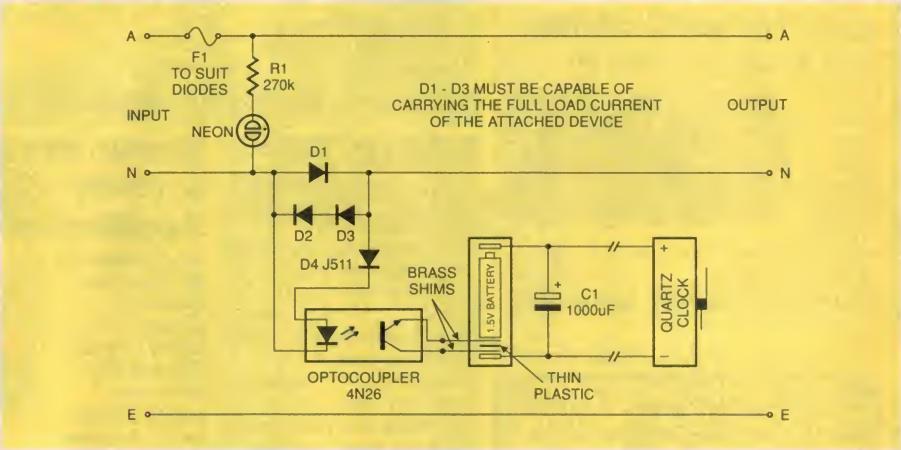
OLD **Only $20ea**

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Mains Monitor



My 'beer' fridge is located out in the garage, (right next to my work bench as it happens!). Sometime ago, I became aware that it seemed to spend a lot of time with the compressor running — and no, I wasn't using it to excess! Before going off half-cocked, I thought it would be a good idea to first record the amount of time that it actually spent running, and that's when I came across the circuit suggestion by R.C. Hilton, Mt Pleasant, WA. (*EA Jan 95, p67*).

Lo and behold, he had experienced a similar problem and had come up with a viable solution. However, I don't like to rip-off another chap's idea without giving something back, so I devised a somewhat different (and possibly, more economical) interface for the clock.

This hardly requires elaboration, but a couple of items bear some justification. The simple, bedside quartz clock I was using runs forever on an alkaline 1.5V AA cell. In other words, it draws very little current. However, it draws this current once every second in (relatively) large 'sips', each lasting about 60ms. Since my opto switch is only on for 10ms at a time, followed by 10ms off, this energy could not be supplied. C1 overcomes this problem by charging during the on periods and maintaining the supply voltage for the duration of the full 60ms. (The penalty is a four-second lag between the mains device switching on and the first tick of the clock.)

The J511 (a 5mA constant current diode from RS Components) limits the current through this arm of the supply line to the few mA required by the opto LED, forcing the surplus load current to flow through D2 and D3.

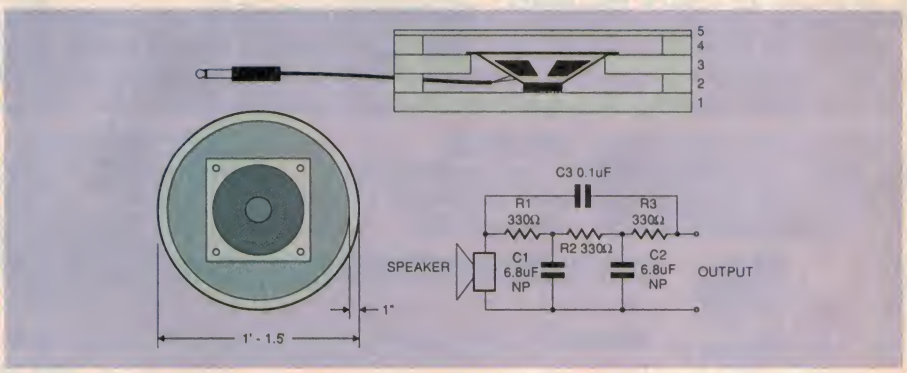
The circuit works fine with a variety of light loads, such as a 40W lamp, a 100W lamp, a small fan, a small TV, a power amp and the suspect fridge. The latter draws just over one amp, the limit for my power diodes. The DC voltage (pulses) across the two power diodes is clamped at about 1.6 volts and the voltage across the LED was pretty stable at 1.25V, leaving 0.35V across the J511.

It also works just as well with three forward diodes, if you would feel happier with a bit more voltage across the J511, or if your chosen optocoupler's LED has a higher forward voltage drop. Don't be tempted to try a coupler with a Darlington output, because it won't work, on account of its much higher output saturation voltage.

And so, did this solve my problem with the fridge? Well no! It turned out that the fridge in question has an auto-defrost function, which meant that it employed a small, permanently heated plate under the drain plate beneath the fridge — so the mains power never goes off completely! Ah well, back to the drawing board...

Brian Critchley
Elanora Heights, NSW **$35**

Electronic 'Stomp Box'



While slightly more mechanical than electronic, this design for a stomp box gives a huge improvement over the usual box-and-microphone, and is cheap and easy to build as well.

The box (or rather cylinder) consists of four 1.5-foot (450mm) diameter disks of 3/4" (19mm) ply, as shown in the diagram. The bottom disk (1) is left whole, while disks 2 and 4 have their centres cut out to leave a 1" (25mm) support rim. A hole is cut in the centre of disk 3 to accommodate the loudspeaker, and the lid (5) is a piece of masonite which acts as the sounding board.

Once you've mounted the speaker in disk 3, drill a hole in the side of the disk 2 for a cable terminated with a 6.35mm mono plug. After connecting the other end of the cable to the speaker terminals, the box can be screwed together with six 25mm countersunk screws on the bottom and eight on the masonite lid. The unit is normally played on the top with your foot, but you can turn it upside-down to give a different sound.

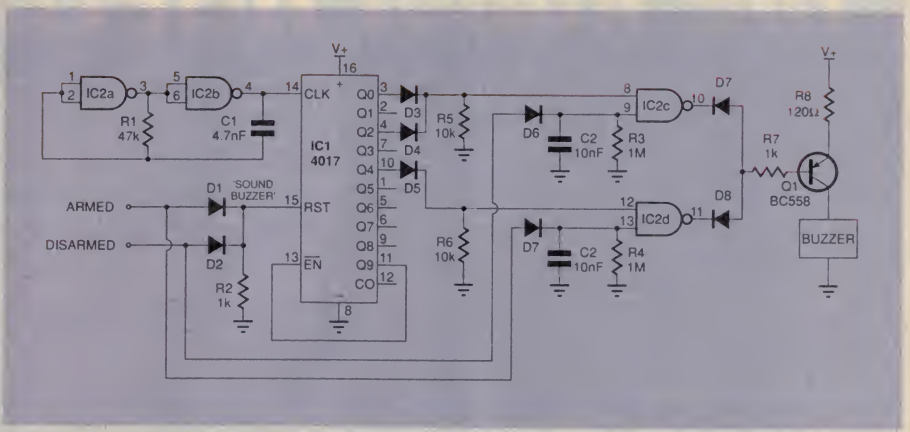
The circuit shown is not vital, but it improves the tone, giving a really 'fat' sound. It consists of C1, R1, C2 and R2, which make a double pole low pass filter with 12dB roll-off at around 70Hz. C3 and R3 are added to let some highs through, creating a notch around 200Hz which gets rid of the boxy sound and improves finger tapping.

David Francis
Cannon Vale, Qld. **$35**

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is an open order to the value of $300 from Oatley Electronics! Yes, that's $300 to spend on anything you want from Oatley's wide range of products, so check out their ad (or their Website) to see what's on offer.

Win our 'IDEA OF THE MONTH' Prize!

Alarm Status indicator



This circuit was designed as an addition to an Oatley Electronics alarm kit. The circuit allows for a programmable audible sequence to indicate the on/off status of the alarm control circuit, and could be added to almost any existing alarm.

A high pulse on one of the two inputs initialises the audible sequence by resetting the 4017 from its clock inhibit state. The 4017 is held inhibited from counting by a high on the Q9 output (pin 11). The Sound Buzzer input may be driven by any alarm outputs by using diodes to provide a logic OR function. In this circuit two diodes were used, one for the 'Armed' line and the other from the 'Disarmed' line.

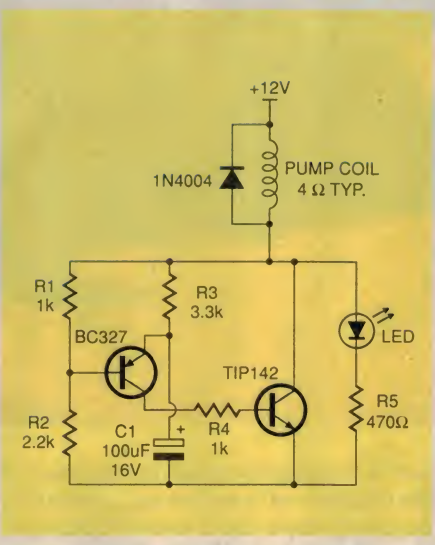
There are two programmable audible sequences that may be selected, by providing a high to either the Alarm Arm/Disarm lines. More are possible and are only limited by the number of NAND gates and diodes used to detect the 4017 counter sequence.

The programming of the unit is done by hard wiring diodes from the outputs of the 4017 (Q0 - Q9). Alternate buzzer on/off sequences of extended duration may be programmed by skipping sequential outputs or wiring sequential pins respectively.

This circuit is quite versatile, and can be adapted to suit a large number of home and car alarms. In the latter case, it would not be difficult to add a relay to the circuit to flash the indicator lights.

Anton Makotter
Plympton Park, SA **$40**

'Pulser' for fuel pumps



Electric fuel pumps in cars are based on a solenoid coupled to a diaphragm, which increases the volume of a chamber when the solenoid is energised.

Atmospheric pressure forces fuel from the tank into the chamber through a one-way valve, when the solenoid is released. A mechanical toggle mechanism operates contacts which control the power to the solenoid. The system spends most of the time in the de-energised state, with the return spring maintaining pressure to the engine.

This is all very well, until the contacts deteriorate to the point where no current flows; the vehicle then becomes unusable.

When this happened to me, I tried to buy a replacement contact assembly and was told, "Naah mate, you can't get them, you'll have to buy a whole new pump..."

"Well, I'll re-surface and readjust the old contacts", I said.

"Naah mate, forget it, you can't repair them."

"Rubbish", I thought. "I'll make it work."

After a lot of fiddling, often at the roadside, I had to concede that maybe he was right. Hence this circuit. It's a conventional two-terminal interrupter which replaces the pump contacts and delivers regular pulses to the solenoid. This means that most of the time the solenoid is pulsed more often than necessary, but it doesn't matter.

What does matter is that it is pulsed often **enough** to keep up with peak consumption. Choose R3 to suit your driving style — if you are going to be scorching down the freeway at 200+ with the pedal to the metal, you'll need the pump pulsing really fast.

The LED is a diagnostic aid, so you can see at a glance that the circuit is working. Note that R5 and the LED provide a path for the back EMF current from the solenoid, but I recommend another diode across the coil to be sure. Actually, fitting a diode across the solenoid may help stop the contacts deteriorating in the first place...

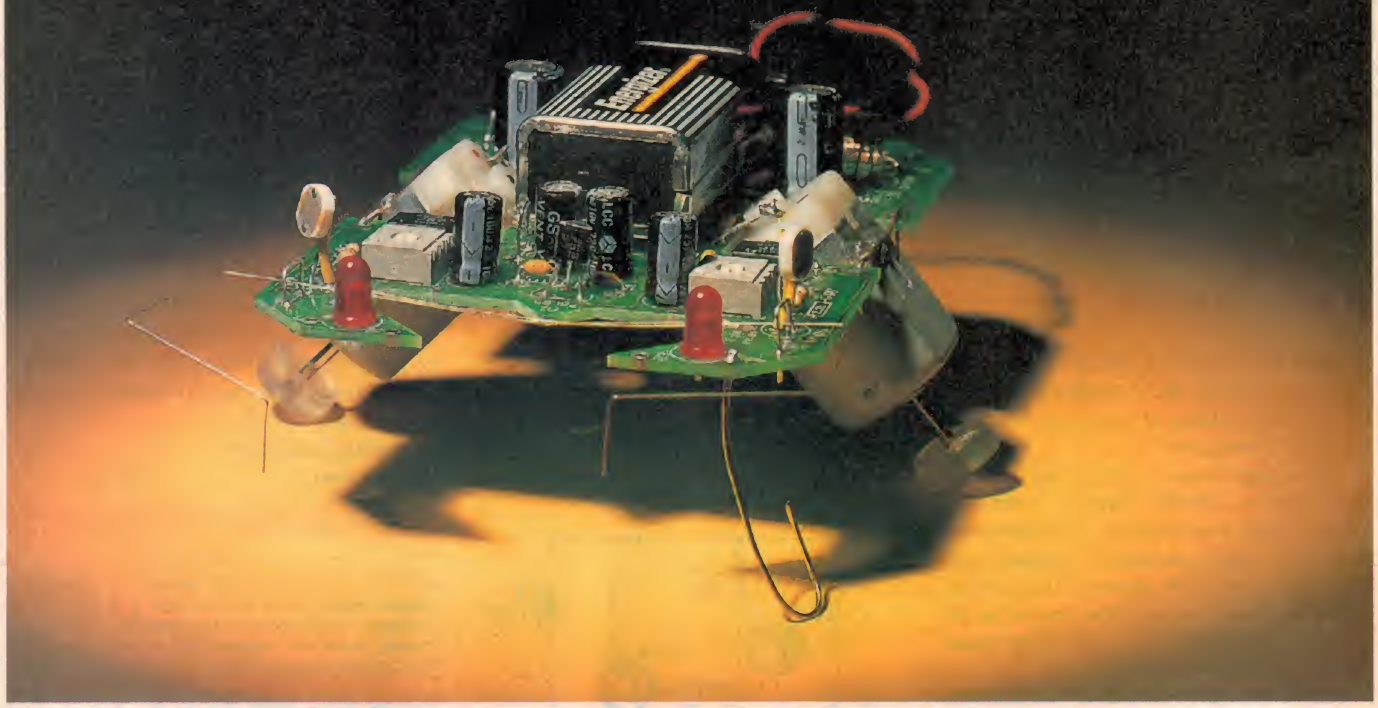
Graham Leadbeater
Ringwood, Vic. **$40** ❖

THIS MONTH'S WINNER!

Build Cybug, the Robot Insect!

Here's your chance to experiment with a robot insect — a novel self-propelled robot that mimics the behaviour of simple insects like a cockroach. Available as a low cost kit from Dick Smith Electronics, it's easy to build and gives you valuable insights into current thinking about the neural behaviour of 'real' insects. It's even capable of being 'upgraded' into a higher life form, by adding modules to provide further 'instincts' such as hunger and predation...

by Jim Rowe



NOT LONG AGO, biologists believed that the nervous system of even small insects like ants, crickets and cockroaches were far too complex for their behaviour to be duplicated using anything less than a fairly powerful computer, coupled to an array of sensors and servomechanisms. Even then, they weren't confident of doing the job particularly well.

In the last few years, though, further work in the area of neural networks and biology has shown that the nervous system of some of these insects may well be a lot simpler than they thought. For example scientists at the University of Nottingham in the UK have built a 'cybercricket' which mimics much of the behaviour of a real cricket, but with an extremely simple neural network made up of only a handful of cells. Similarly a team at the University of Zurich in Switzerland has built a robot 'ant' which mimics the uncanny navigational abilities of the 'desert ant' *Cataglyphis*, using only a tiny number of artificial neuron functions. (For more information on these projects see the URL list near the end of this article.)

You don't have to be a high-powered behavioural scientist to have fun and explore the behaviour of simple artificial insects, though. In fact it's now easy to build your own, thanks to a new low cost kit being marketed in Australia by Dick Smith Electronics.

Called the 'Cybug', it's a kind of artificial cockroach — which can be set up to mimic quite a few of the behavioural characteristics of these delightful(!) creatures. It's essentially nocturnal, with an activity level inversely proportional to ambient light level; can sense and move away from physical obstructions like walls; can be set to be either energetic or lethargic; and can also be adjusted to be either photophobic (light avoiding) or phototropic (light seeking).

With the addition of optional 'higher brain function' modules, the Cybug can also be

given a 'hunger instinct' and/or a 'predation' instinct. The hunger module (HBF-1) gives it the ability to monitor the charge level of its internal battery (i.e., sense when it's 'hungry'), and then seek out 'food' (a battery charging station identified with a light) and 'eat' (recharge its battery). Similarly the predation option HBF-2 — a set of two small modules — lets you configure two Cybugs as 'predator' and 'prey', where the predator seeks out the prey using infra-red light.

(I should add here that these higher brain function modules aren't available from DSE as yet. They plan to wait and see how popular the Cybug project itself is, before adding them to stock. However I expect that Cybug is going to be very popular, so it'll probably be no time before kits for the HBF modules are available too. I also suspect that more modules may arrive, in the not too distant future...)

But where did the Cybug come from — who designed it? Well, its designer is Craig Maynard, an energetic electronics and IT instructor at the Southern Alberta Institute of Technology in Calgary, Canada. Mr Maynard is also a keen robotics experimenter and supporter of education in robotics and electronics. He's also the founder of the Western Canada Robot Games, a yearly competition to promote robotics among Canada's young people.

Cybug arose from his activities to promote interest in DIY robotics and experimentation, and he has set up his own company to manufacture and market the kits for Cybug and its HBF modules. He's appointed DSE as his distributor here in the South-East Asian region, so that's how we're able to write about it — and how you're now able to build one, if you'd like to get involved in this interesting and topical area.

Cybug anatomy

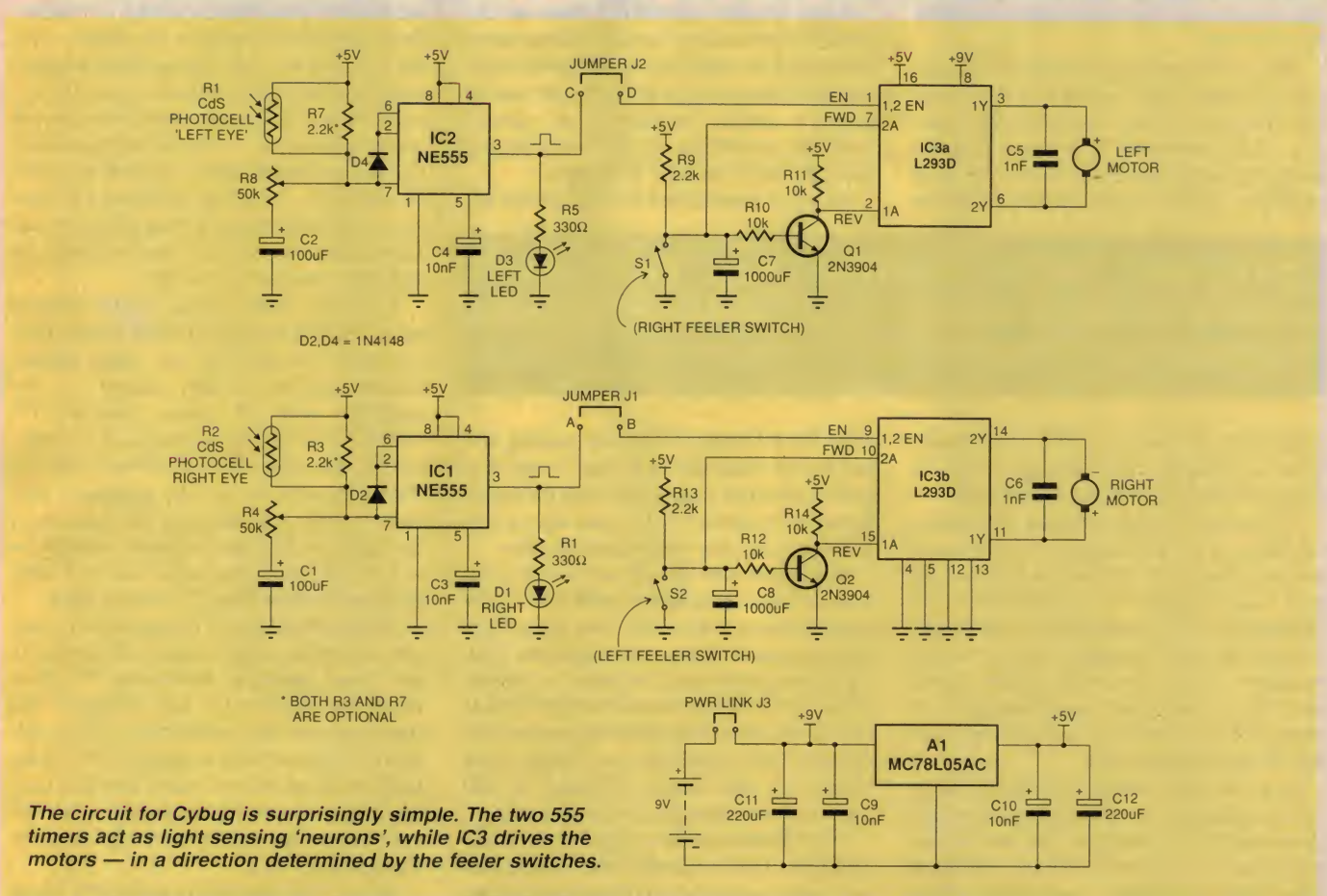
In appearance, as you can see from the photos, Cybug is rather different from most robots you may have seen. It does look a bit like a 'bionic cockroach', with everything built on a small printed circuit board, and a pair of sensing 'feelers' at the front — along with a pair of blinking LED 'eyes'.

Traditionally, building any kind of robot (even a very simple one) has been anything but easy — mainly because of all of the mechanical components required to get the robot 'mobile'. The Cybug gets around this problem very ingeniously: instead of complicated 'legs' and steering mechanisms, it simply uses a pair of small electric motors (one on each side), angled down at about 45° and fitted with small wheels. These are controlled by the electronics, to provide both mobility and steering. To keep the body of Cybug from pitching forward or back, there's a simple wire 'skid' at each end, in diagonal corners. It's very well thought out, easy to build and yet completely effective.

By the way the LEDs up at each of Cybug's front corners aren't really anything to do with vision. They're basically indicators that it's 'awake' — showing the firing of its two main light-sensing 'neurons'. The robot's main 'eyes' are really the two small light-dependent resistors, which you can see just behind and to the side of the LEDs. It's these that provide Cybug with its awareness of the ambient lighting level and the main direction of any light source.

The basic Cybug runs from a standard 9V alkaline battery, which is only replaced with a NiCad rechargeable type if you choose to add the HBF-1 Hunger Instinct module later on. The battery mounts on the PCB in the centre of Cybug's body, where it helps ensure balance. A two-pin header strip down at its 'rear end' acts as the robot's on/off switch, with a jumper used to bridge the pins when you want it to spring into life.

By the way, that oddly-shaped PCB which forms Cybug's body and 'skeleton' is more than it may seem. As well as being sculpted to look a bit like a bionic insect, it's been carefully designed to allow for easy mechanical construction, reliable operation and also

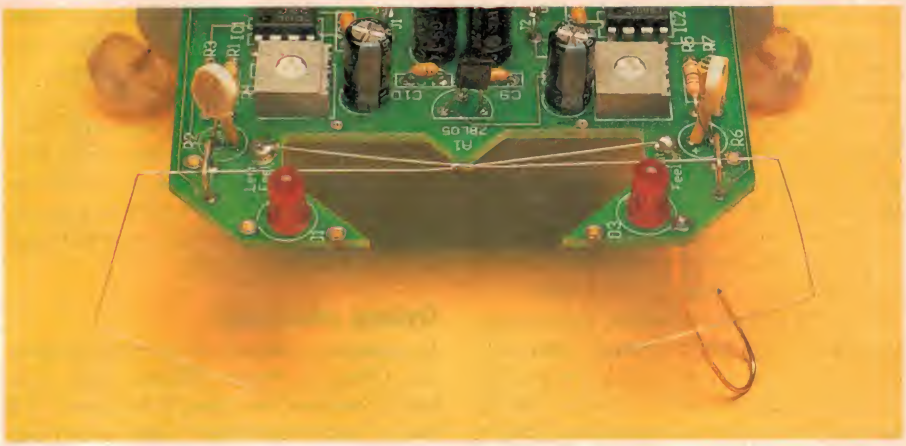


The circuit for Cybug is surprisingly simple. The two 555 timers act as light sensing 'neurons', while IC3 drives the motors — in a direction determined by the feeler switches.

easy expansion. It's also a very high quality double-sided board, with plated-through holes and clear silk screening to facilitate parts placement.

You'll probably be amazed to learn that the electronics which 'runs' Cybug consists of only three low cost ICs, two transistors and a low-power voltage regulator — plus a handful of passive parts. That's because designer Craig Maynard has been most ingenious, and used simple analog circuitry to achieve functions based on modern understanding of the operation of neural cells and their interconnection in biological networks.

So let's now look at how Cybug actually works...



This closeup of the front of a Cybug shows how the feeler switches are bent up, from 0.5mm springy brass wire. Also visible is the front support 'skid', at lower right.

Inside the circuit

Cybug's circuitry can be split conveniently into two main sections: the sensing or 'affect' section and the action or 'effect' section. And because it's a symmetrical 'creature', each of these sections can be split further, into right-side and left-side subsections.

As it happens the right and left sides of the creature are also largely independent in their basic operation, with the right-side sensing circuitry mainly controlling the action circuitry on that side only, and the same for the left side. So for the first part of this description, we can look at the operation of just one side, because the other side works in exactly the same way.

Most of the sensing circuitry for the left side of Cybug is that around IC2, a low cost 555 timer chip which is wired so that it acts as a simple 'nerve cell' or neuron, firing and producing output pulses under the control of cadmium sulphide light-dependent resistor (LDR) R6, and preset pot R8. These determine the charging and discharging of IC2's timing resistor C2, a 100uF electrolytic.

The circuit is a fairly standard 555 astable oscillator, with the charging of C2 determined by both R6 and R8, and sensed by pins 2 and 6 of the 555 via diode D4. The discharging of C2 is essentially via R8 alone, through the 555's discharge pin 7. As the resistance of R6 is typically rather higher than R8, a convenient simplification is to regard R6 as controlling the charging time and R8 the discharge time.

So in the light, where LDR R6 is fairly low in resistance, the charging time is fairly short and the 555 produces very narrow output pulses. As a result LED D3 will blink only briefly and faintly, and as the pulses from IC2 are also used to drive the left side's motor circuitry (via link J2), that motor will get very little average drive.

On the other hand when the lighting level around R6 falls, and its resistance rises, the time to charge C2 increases and the 555 produces somewhat wider output pulses. As a result D3 will now produce rather more obvious flashes, and the left side's motor will receive much longer (and hence stronger) drive pulses.

So the circuitry around IC2 forms an elementary light-sensing 'neuron', whose output pulses vary in width inversely with the lighting level detected by LDR R6. Pot R8 sets the neuron's overall 'sensitivity' or 'activity level', by controlling the 555's discharging time (and hence its pulse frequency).

As you'd expect, the circuitry around IC1 and LDR R2 forms an identical sensing neuron for the right side of Cybug, working in exactly the same way. In this case the output pulses are indicated by D1, and fed via link J1 to the right-side motor drive circuitry.

"Designer Craig Maynard has been most ingenious, using simple analog circuitry to mimic the operation of neural cells..."

By the way, with links J2 and J1 used in this way to couple the output of each side's light-sensing neuron to the motor drive circuitry on the same side of Cybug, it tends to have light-seeking or 'phototropic' behaviour — because the motor on the side nearest the light tends to receive less drive. This makes the motor on the opposite side dominate, so Cybug veers *towards* a light source (although it still becomes more lethargic as it gets nearer).

This behaviour can be changed by cross-connecting the links, so point C (the 'left eye neuron' output) connects to B (the right-side motor drive input), and point A to D. Then Cybug will veer *away* from light sources — i.e., it becomes 'photophobic'. You have a choice as to which way you connect these links.

Now we still haven't quite finished with Cybug's sensing circuitry yet, because there's still its contact sensing 'feelers' to consider. And the circuitry for these sensors is slightly more tricky to understand, because (a) it's more closely associated with the motor drive circuitry on each side; and (b) these sensors are the area where there's *always* a crossover from one side of Cybug to the other — i.e., the feeler on the right side controls the drive to the left-side motor, and vice versa. The circuitry for the feeler sensor controlling the left side's motor drive is that around transistor Q1, and as you can see it's connected to feeler switch S1 — the one based on the feeler wire on the *right* side of Cybug. (Similarly the *left* side feeler switch S2 is used to control the *right* side motor drive, via Q2.)

Normally, when Cybug hasn't bumped into any walls or similar bodies with its feelers, both S1 and S2 are open circuit. Considering the circuitry around Q1, for example, with S1 open capacitor C7 (1000uF) will be able to charge up via resistor R9, providing Q1 with forward bias via R10, and turning it on. The transistor's collector voltage will therefore fall. As a result the logic level on the 'Reverse' control line will be low, while that on the 'Forward' control line (directly from C7) will be high.

On the other hand if Cybug should bump into something with its right-side feeler, S1 will close, suddenly discharging C7. As a result the bias for Q1 will disappear, the transistor will stop conducting, and its collector voltage will rise to around +5V. So the logic levels on the two motor direction control lines will now be the opposite of before: the Reverse line will now be high, and the Forward line low.

As you can see, Q1 is essentially being

used as a basic logic inverter, providing a complementary logic signal from the simple 'feeler sensor neuron' formed by S1, R9 and C7. And the neuron itself is quick to 'fire' when the sensor touches anything, but relatively slow to recover (taking about a second) due to the time needed for C7 to recharge via R9.

Needless to say the circuitry around Q2 operates in exactly the same way, in this case driven from feeler switch S2.

OK, now we've looked at Cybug's touch-sensing circuitry as well as that for light sensing, let's see how the signals they produce are used to control its motors. As you can see this task is handled by IC3, which single-handedly provides all of Cybug's motor driving circuitry.

IC3 is a flexible L293D (ST Microelectronics) four-channel driver chip, designed specifically to drive inductive loads such as DC and stepper motors, relays and solenoids. It includes built-in clamping diodes on the outputs, and can operate from supply voltages as high as 36V, and control peak output currents of over 1A. A very handy feature is the way each pair of its drivers are provided with a common 'enable' logic input, so that they can easily be used as push-pull or 'bridge mode' drivers. And that's exactly how they're being used here...

As you can see, Cybug's left-side motor is driven by channels 1 and 2 of IC3 (shown as IC3a), while the right-side motor is driven by channels 3 and 4 (IC3b). These driver pairs are connected in exactly the same way, so we'll discuss them together.

Basically the output pulses from Cybug's light-sensing neurons are fed to the Enable inputs of each motor driver pair, so that the motors receive current in pulses, with a width as determined (inversely) by the light levels on the sensor LDRs. But the Forward and Reverse control lines from the feeler switches and their inverters are then fed to the inputs of the individual motor drivers, so the pulses are used to drive the motors in the forward direction if the feelers on the 'other side' are *not* activated, or in the reverse direction if they *are* activated.

So to summarise, each of Cybug's motors is 'active' according to how *little* light is falling on the LDR on that side of the beast, but which direction it rotates in depends on whether the feeler switch on the *opposite* side has come into contact with an obstacle, in the last second or so.

It may all sound fairly straightforward, but in practice this simple sensing and control circuitry is all that's needed to give Cybug its realistic 'robot cockroach' behaviour, scuttling around in dim light conditions and backing away from obstacles and light sources...

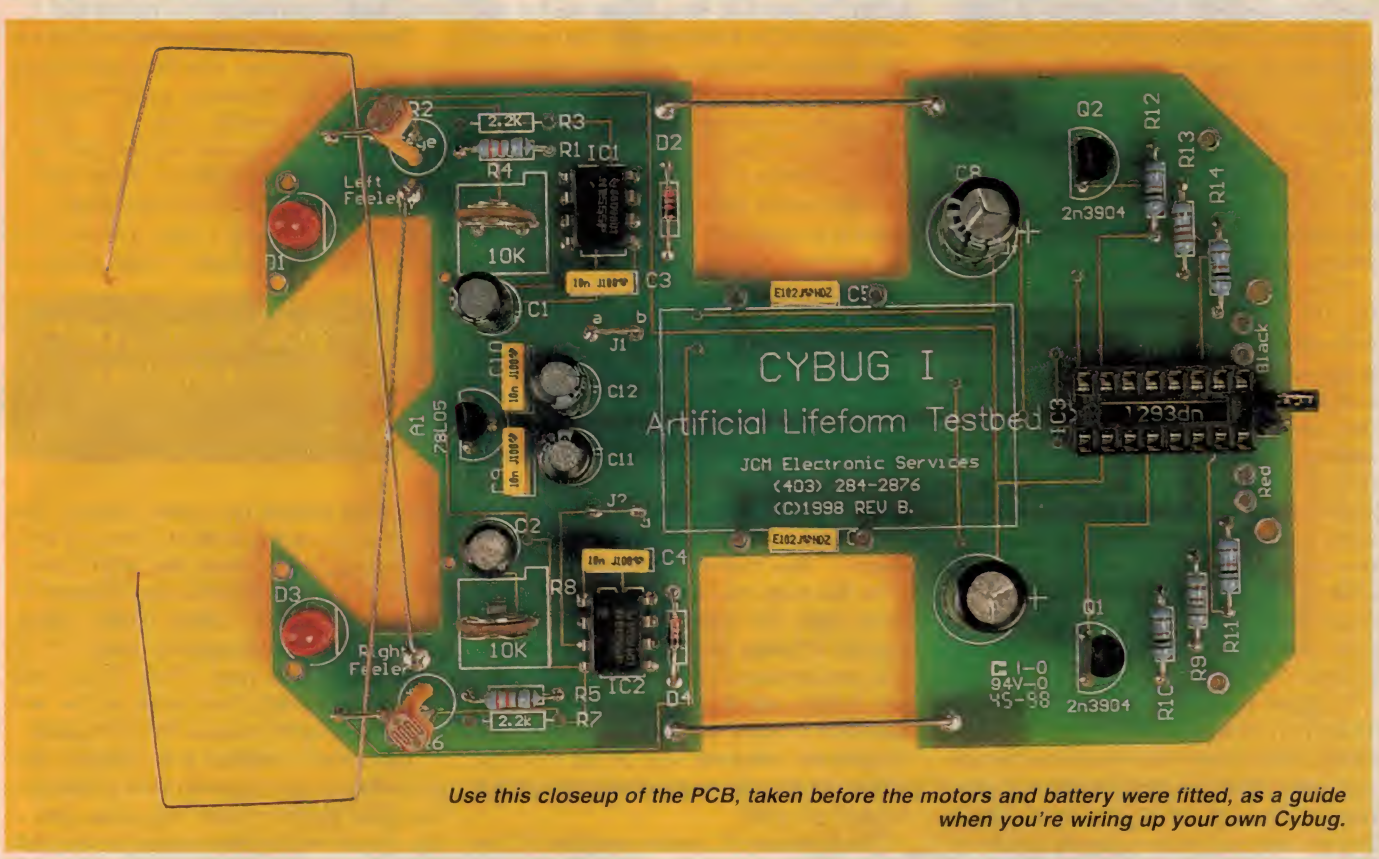
Oh, I've almost forgotten the power supply. As you can see from the schematic, this is very simple. The unregulated 9V from the battery is used to supply the motors directly, via IC3, while a 78L05 regulator is used to derive a regulated +5V supply for the logic circuitry. Capacitors C9 - C12 are used for noise filtering and regulator stability, while C5 and C6 are connected across the two motors to reduce hash and EM radiation.

Construction

Thanks to the way Craig Maynard has based Cybug on a PCB 'body', assembling it is very similar to wiring up any other fairly simple electronics project. I gather that the DSE kit will also have very clear step-by-step instructions, complete with a primer on soldering and a guide to components identification for those who haven't assembled any previous kits or projects. However for those with a little more experience, here's a brief 'fast track' rundown.

First of all, I suggest you check that everything is in your kit, by comparing it with the parts list. There's nothing worse than *almost* completing a project, only to find that you're missing two crucial parts — and it's late at night, or 5pm on a Sunday afternoon!

If all seems well, my suggestion is that you fit the main wire links to the PCB before fitting any of the components. There are the two stout links for supporting the motors, between the outer corners of the motor cutouts; these are bent up from straightened 1mm tinned copper (TC) wire, with a centre section 32mm long and the ends cranked at 90° to go through the holes provided, before soldering. These links mount on the top of



Use this closeup of the PCB, taken before the motors and battery were fitted, as a guide when you're wiring up your own Cybug.

the board, by the way.

Then there are two small links made from 0.5mm TC wire (or component pigtail offcuts), which fit right up at the front corners of Cybug, just ahead of the locations for LDRs R2 and R6. These links are bent as small 'U' shapes, with the sides about 6mm long and 5.5mm apart. They mount inverted, again on the top of the PCB, and with the horizontal arm about 4mm above the board. (These links become part of the feeler switches.)

The final links are those for J1 and J2, and here you need to decide whether you want your Cybug to be phototropic or photophobic. If you want it to veer *towards* light sources, just fit short links between A - B, and C - D. These links can be about 5mm long, and bent from 0.5mm TC wire.

On the other hand if you want Cybug to veer *away* from light sources, you'll need to find longer 'crossover' links, connecting A-D and C-B. These links should be at least 22mm long for the horizontal segment, and made from insulated hookup wire to prevent 'shorts' where they cross.

(If you don't want to make a decision about Cybug's light-related behaviour at this stage, or prefer to have it easily changed at a later stage, you may prefer to fit four PCB terminal pins at points A-D. You'll then be able to determine and/or change its behaviour later, using say two small insulated links fitted with slip-on clips.)

Now you should be ready to fit the passive components, starting first with the resistors. Note that LDR shunt resistors R3 and R7 are optional, and probably best left out. You can also fit the preset pots R4 and R8, which may be of either the horizontal or vertical type — but their leads may need a bit of straightening before they go through the PCB holes without strain.

Then you can fit the MKT capacitors C3, C4, C5, C6, C9 and C10, which like the resistors mount down against the top of the board. These can be followed by the smaller electrolytic caps C1, C2, C11 and C12, and then the two larger electrolytics C7 and C8, making sure you fit them with the correct polarity in each case. Note that while the smaller electros will probably slip down and allow mounting right against the board, the two larger ones will probably need their leads gently cranked apart to mate with the 6mm-spaced PCB holes, and hence will have to be mounted 2-3mm proud of the board to prevent lead strain.

I suggest you mount the two LDRs next. These have to mount about 8mm above the board, to allow their leads to be bent for correct orientation of their sensitive 'faces' (about 45° to the PCB, and outwards so they're 'side on' to the adjacent LEDs). If you cut the leads at about 10mm from the LDR body and fit one with an 8mm length of varnished cambric sleeving, this should help in mounting them the right distance from the PCB and also prevent shorts when they leads are bent to point the LDRs in the right direction. Note that although the PCB legend suggests that the LDRs are polarised, they're not.

You can now mount diodes D2 and D4, taking care with polarity and also not to strain their leads. Then you can mount the two

Here's a closeup of one of the Cybug motors, to show how they're fitted into the side slots of the PCB.

LEDs, D1 and D3; these mount hard down against the PCB, with the small 'flat' on their body towards the rear (i.e., pots R4 and R8).

The next step is to fit transistors Q1 and Q2, taking care to orientate them as shown by the PCB silk-screening. You'll need to crank their leads out gently to mate with the PCB holes, and then mount them about 5mm above the board to prevent lead strain. The 78L05 voltage regulator A1 is mounted up at the centre front of the PCB, in exactly the same way. (Make sure you don't confuse it with the transistors — they're all in TO-92 cases.)

At this stage you can mount the two 555 timer chips, IC1 and IC2. These don't need sockets, although they may be supplied and you can use them if you wish. Just make sure you fit them with the correct orientation: the end with a notch or 'dimple' near it goes towards the left-hand side of the PCB, as shown by the silk-screened legend and the 'square' pin pads.

The remaining IC, motor controller IC3, is best mounted in a socket as this will allow you to test Cybug's 'front end' circuitry later, before the chip is fitted. So for the present, simply solder in the supplied 16-pin DIL socket, making sure its notched end corresponds to the silk-screened legend (i.e., is towards Cybug's 'front').

With this socket fitted, you might also want to mount the two-pin header strip just to its rear, ready to form part of Cybug's 'on/off' switch when the jumper is slipped on later.

You're now essentially finished assembling the purely electronic section of Cybug. What's left is the electromechanical section: the feelers, the motors, the support skids and the battery and its snap lead. I suggest you tackle these items in that order, for convenience.

The feelers

To make the feelers, you need to cut two lengths of straightened springy fine (about 0.5mm) brass wire, each about 125mm long. Make a 90° bend 4mm from the end of each, for the part which will solder into the PCB, and then poke each wire's long section through the sensing loop on the *opposite* side of Cybug's front, until the 5mm return can be pushed down through its designated mounting hole. (i.e., the left feeler has its return fitted to the hole marked 'Left Feeler', but passes through the sensing loop on the opposite side. And vice-versa for the right feeler.)

The two feelers should now be soldered into their respective holes, with their main lengths held so that they're passing neatly through the *centre* of their sensing loops (i.e., without touching). You may want to hold them temporarily in the correct position with a blob of Blu-Tak or tape, while you're soldering.

Once the soldering's done, you can then make the remaining bends to each feeler, so they bend around for correct sensing. The first bend in each is at about 10mm out from the sensing loops, where then bend forward to become parallel with the main sides of the PCB; then about 22mm further along, they're bent inwards again by about 75°, so their ends almost meet. Then, if you wish (it's not essential), their ends can be bent downwards again at about 90°, for rigidity.

This should complete your Cybug's feelers, although you may also wish to tack-solder them together where they cross, just at the 'point' in the front centre of the PCB

"You need to decide whether you want your Cybug to be phototropic (light seeking) or photophobic (light avoiding)..."

(i.e., just in front of regulator A1). This helps keep them aligned correctly through the sensing loops, while ensuring that they can still be sensitive enough to detect Cybug coming into contact with obstacles.

Now you should be ready to fit the motors.

The motors

If you look carefully at the plastic 'back end' of the motors, you'll see a spot of red paint near one of the two connection lugs. There may also be a stripe of red paint along the body of the motor, on the opposite flat side. Each motor mounts in the Cybug with the 'red spot' terminal uppermost, and the stripe side underneath. They mount at about 45°, as you can see, with the 'spotless' connection lug virtually resting on the top of the PCB next to its connection pad, and the uppermost (non-striped) body flat up against the stout wire links, about 7mm from the plastic end piece. They're held in place by the soldered connections and two solder joints between each motor body and its stout wire link.

Before offering each motor up to the board, clean the surface of each non-stripe flat about 7mm from the plastic end, ready for soldering. This can be done with fine sandpaper, or by scraping with a hobby knife. You can also solder two short lengths (say 14mm) of 0.5mm TC wire to the connection lugs, both leading downwards (i.e., towards the striped side of the motor).

You should now be able to offer each motor up from underneath, connection end first, with the leads inwards, and by directing each lead down through its corresponding PCB hole you should be able to maneuvre it so that its body will come to the correct angle to the board, with the 'spotless' connection lug resting on the top of the PCB, and the metal motor body flat against the outside support link. It can then be fixed in this position by soldering the two connection leads into the PCB, and also applying solder to the motor body and support link (you'll need a reasonably powered iron to do this properly).

To finish off the motors, you'll need to add the wheels. These are simply two short sections (say 5mm) of hot-glue stick, with a small hole drilled or pushed through the centre using an awl or nail, and then each simply pushed onto the end of a motor spindle. They stay there quite happily, and provide good traction despite their 45° raking.

Skids, battery

With the motors in position, you'll be able to fit the support skids to Cybug's front and rear. These are simply 60mm lengths of 1mm TC wire, soldered to the PCB at the left front (just out from D3) and the right rear (just out from R13). They run downwards from the PCB, of course, and their free ends are bent back into open 'U' loops about 15mm in diameter, in such a way that when Cybug is resting on a flat surface, its motor wheels are firmly on the surface. It should be able to rock back and forth by a small amount before each skid touches the surface — so they provide stability without degrading traction.

The final assembly step is to fit the battery snap lead to the rear of Cybug, with the red lead looping through the larger hole out from R11 and soldering to one of the smaller holes marked 'Red'. Similarly the black lead loops through the larger hole out from R14, and solders to one of the smaller holes marked 'black'.

The battery itself mounts on the centre top of the PCB in the marked rectangular area, with its connection clips towards the rear. It's held in position using one of the pieces of double-sided tape supplied in the kit.

Your Cybug should now be complete and ready for testing.

Checkout

To begin its checkout, connect the battery snap lead to the battery clips, then fit the jumper across the two pins at Cybug's rear, to apply power. At this stage motor driver chip IC3 should still not be fitted.

If all is well, the two LEDs should begin to blink — possibly at rather different rates. If you have a multimeter or DMM, try checking the voltage at pin 8 of either IC1 or IC2. It should measure +5V, compared with Cybug's board common (e.g., one of the feeler wires). If it doesn't measure +5V, and/or the LEDs aren't blinking, remove the jumper to switch off, and search for the problem. You may have fitted the voltage regulator wrongly, or fitted one or more of the electrolytic capacitors around the wrong way. Or if the voltage checks OK but the LEDs don't light, you may have fitted the LEDs in backwards...

Presuming everything is OK so far, place Cybug in normal room lighting and adjust each of the two preset pots R4 and R8 with a small screwdriver so that the corresponding LED (D1 and D3, respectively) blinks 'on' for about 1/3 to 1/4 of the time. They won't be blinking in synchronism, but each should be blinking at about the same rate and be 'off' between blinks for about 3-4 times and long as the blinks themselves.

With this done, your Cybug is almost ready for action. All that's required is removing the power jumper, carefully fitting motor control chip IC3 into its socket (notch end towards the battery), and then refitting the power jumper.

The motors should then begin spinning, and if you place Cybug down on a fairly flat and smooth floor or other horizontal surface, it should immediately begin exploring the environment.

Have fun, and in the process learn a bit about robot behaviour! ❖

Parts List

Resistors

R1,5	330 ohms
R2,6	CdS LDR
R3,7	2.2k (optional)
R4,8	50k linear trimpot, small
R9,13	2.2k
R10,11, 12,14	10k

Capacitors

C1,2	100uF 16VW RB electrolytic
C3,4, 9,10	10nF MKT
C5,6	1nF MKT
C7,8	1000uF 16VW RB electrolytic
C11,12	220uF 16VW RB electrolytic

Semiconductors

D1,3	5mm red LED
D2,4	1N4148 signal diode
Q1,2	2N3904 NPN silicon
A1	78L05 5V regulator
IC1,2	NE555 timer IC
IC3	L293D motor driver IC

Miscellaneous

Cybug PCB, 116 x 77mm; 16-pin DIL socket for IC3; 2 x DC hobby motors; 1 x 2-pin header strip, with jumper; 2 x 40mm lengths of 1mm TC wire; 2 x 125mm-long straight pieces of 0.5mm springy brass wire; 4 x 15mm-long pieces of 0.5mm TC wire (for feeler hoops, PCB links — see text); 4 x 14mm-long pieces of 0.5mm TC wire (for motor connections); 2 x 4mm-long slices of hot-glue stick, 12mm diameter; 9V alkaline battery; battery snap lead; solder, etc.

Useful URLs & references

Here are some web sites you might like to visit, for more information on either Cybug or other research into robot insects:

http://members.home.com/cybug (Cybug designer Craig Maynard's home page)

http://www.robotgames.com (Western Canadian Robot Games site, Calgary, Alberta)

http://www.psyc.nott.ac.uk/staff/Barbara.Webb/publications (University of Nottingham robot cricket research)

http://www.ifi.unizh.ch/groups/ailab/projects/sahabot2/ (University of Zurich robot ant research)

Another reference you'll probably find of interest is the article 'March of the Biobots', by Duncan Graham-Rowe, in the December 5, 1998 issue of *New Scientist* magazine.

$10 Wonders

21 — Sound-operated trigger

Our previous $10 Wonder, the Nightlight, has a pushbutton switch which triggers the lamp to switch on for a preset period. This month's marvel is a sound-operated trigger that turns on the light at the slightest whisper. It's simple and easy to build, and makes a good addition to last month's project.

THIS NEW ADD-ON makes it easy to turn on the Nightlight without having to fumble for the switch in the dark, perhaps knocking over the lamp in the process. Just clap your hands, click your fingers, whistle, cough, sneeze, or make an inane remark, and on comes the light.

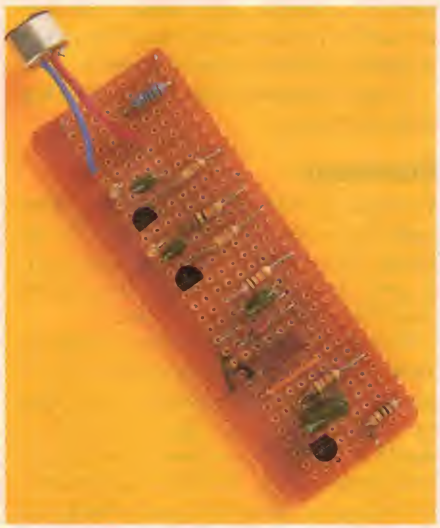
For reasons that will be described later, this is an extremely sensitive circuit. It detects any of the above sounds at distances up to four metres or more, which is more than enough for this application.

The Nightlight circuit and this trigger circuit together can be adapted for several practical functions such as a porch light, a corridor lamp or an intruder detector. Some sample circuits will be described in a later issue.

How it works

The microphone (MIC1 in Fig.1) is a low-cost electret microphone of the kind that is often built in as part of a tape recorder. An electret microphone depends on capacitance for its action. It has two metal plates placed close together with a thin layer of dielectric (insulation) between them. The capacitance between the plates depends among other factors on the distance between the plates.

Sound waves make the plates vibrate, and this alters the gap between the plates and thus alters the capacitance proportionately. Although capacitance (C) is varying, the charge (Q) on the plates remains fixed. The potential difference between the plates is V = Q/C, so if C varies, then V varies too. The result is an AC voltage which is a replica of the original sound wave.



Build this sound trigger for the Nightlight featured last month, and you'll only need to shout or clap your hands to turn it on. It can be adapted for other projects too, so have a go...

An electret microphone differs from a traditional capacitance ('condenser') microphone in that during manufacture the dielectric is heated and then allowed to cool in a strong electric field. This leaves it with a permanent charge on the plates, so it doesn't need a separate high voltage power supply.

The problem is that the output impedance of any capacitance microphone is so high that it is hard to get a decent signal out of it. Electrets have a built-in FET impedance matching amplifier to address this problem, and only require a low voltage power supply (provided in this case by the dropping resistor R1).

So, our microphone converts the sound waves into an AC voltage, which pass through capacitor C1 to the base of the transistor Q1. Now Q1 might look like an ordinary three-terminal transistor, in its TO-92 package, and it costs the same as an average transistor; but it is really *two* NPN transistors on the same chip, known as a Darlington transistor. Fig.2 shows the internal arrangement a little more clearly.

The way the Darlington works is like this. When a small base current flows into the base of QA (Fig.2), about 100 times that current flows through its collector-emitter junction. This is because the current gain of a typical transistor is about 100. In the Darlington configuration, the emitter current of QA becomes the base current of QB. So when this current flows into QB, its base current is again amplified 100 times, and so there is further current gain of 100. As a result the pair of transistors have a current gain of 100 x 100, or 10,000. So the small signal from the microphone is amplified 10,000 times, making the circuit sensitive to the slightest sounds.

A potential divider consisting of R2 and R3 biases Q1 so that the voltage at the collector and C2 is approximately half the supply voltage — that is, about 3V.

The microphone signal is amplified by Q1, and the variations in collector current produce a varying voltage across R4. The voltage swings to either side of 3V when a sound is detected. This voltage signal pass-

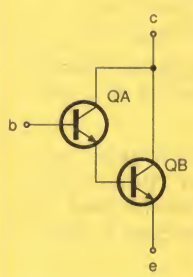
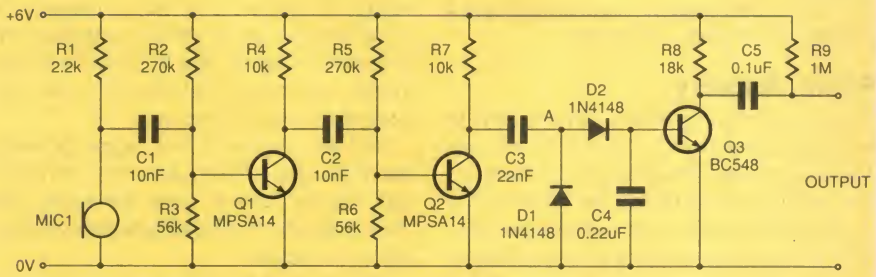
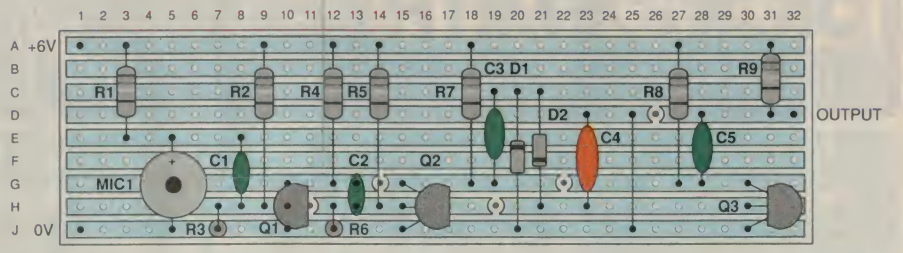


Fig.1 (left) Inside a Darlington transistor — gains of 10,000 are not uncommon. Fig.2 (right) The two Darlington transistors Q1 and Q2 amplify the microphone signal, while the diode pump (D1 and D2) helps to increase the circuit's sensitivity.



by Owen Bishop

Use this overlay diagram to wire up the Sound Operated Trigger. There are only five cuts to be made in the stripboard, and one of these is hiding under Q1, so don't miss it.



es through C2 to the next stage, which is another Darlington transistor used for a second stage of amplification.

The second stage is identical to the first, and the output signal passes through C3 to the next stage. Since the signal swings on either side of the halfway voltage it does not matter that the signal is inverted by Q1 and then inverted again by Q2.

The next stage is a 'diode pump', consisting of two silicon diodes D1 and D2, and this is another mechanism for increasing sensitivity.

Consider what happens during a negative-going signal half-cycle, at the collector of Q2. Capacitor C3, which is normally charged to half the supply voltage, with point A at ground potential, suddenly finds that it cannot simply pass this voltage drop through, because D1 prevents point A from going negative with respect to ground. So what happens is that C3 is partially discharged.

Now when the collector voltage of Q2 rises, during the next positive-going signal half-cycle, C3 not only passes this signal voltage rise through to point A, but tries to recharge again. And this time although D1 cannot conduct, D2 can — passing both the signal and recharging currents though to charge C4. The voltage at A tends to rise above ground, because C3 can't fully recharge.

When the signal polarity reverses again, D2 can't conduct so the charge delivered to C4 remains there. However now D1 conducts again, allowing C3 to partially discharge once more — or if you prefer, recharge with point A floating more positive with respect to ground. Then when the signal swings positive once more, a combined current flows again through D2 into C4.

So the end result is that both negative and positive signal half-cycles are effectively added together, and used to 'pump up' the charge voltage on C4 — very much like a voltage-doubling rectifier. In fact the longer the signal lasts, the more the voltage developed across C4 builds up and approaches the peak-to-peak signal voltage on Q2's collector — or approximately double the DC level that builds up at A. (Ignoring diode losses.)

In this way the diode pump helps the circuit to respond to sounds that are less loud, but continue for a longer time. The voltage soon becomes high enough to switch on Q3, which is an ordinary single NPN transistor. As Q3 switches on, the normally high voltage at its collector falls sharply; this low-going voltage edge passes through C5, triggering the timer IC in the Nightlight.

After the sound has ceased, the charge on C4 slowly flows away through the base-emitter junction of Q3. In a typical diode pump there is a bleed resistor to discharge C4, but it is not needed in this circuit because supplying base current to Q3 has exactly the same effect. As the voltage at A falls, Q3 switches off and the output returns to its normally high level. This leaves the circuit ready to respond to the next sound.

Construction

The circuit is built on a narrow scrap of stripboard and could possibly fit in the base of the Nightlight. The strips are cut at only five places but it is essential to get these cuts in the correct locations, otherwise the circuit will not work.

The way the microphone is mounted depends on your preference. In the prototype two stiff (single-core) copper wires about 3cm long were soldered to the pads on the rear of the microphone and these were soldered directly to the circuit-board. You could use longer, flexible wires and it is possible to buy the microphone with these already soldered on. However, if the leads are to be more than about 10cm long, use light-duty single-core shielded cable.

Solder the core to the positive terminal of the microphone and the shield to the negative terminal. At the other end solder the core to the strip near to the lower end of R1, and the shield to the 0V line. This will prevent the microphone from picking up EMI which, in the case of this circuit, would soon build up a triggering voltage on the base of Q3.

The rest of the circuit is straightforward — apart from noticing that the flat surfaces of Q1 and Q2 face right, but that of Q3 faces left. Also make sure that the two diodes are soldered in with the correct polarity. The values suggested for R2, R3, R5 and R6 should bias the Darlingtons so that the voltage at their collectors is around 2V to 3V. The stages of the circuit are coupled by capacitors so the exact voltages do not matter, provided they are not too close to the power rails.

In the absence of sound, the voltage at point A was about 0.2V in the prototype and rose to about 1V with sound. The important thing is that it is less than 0.6V with no sound and rises above that value when a sound is present. The voltage at the collector of Q3 is normally 6V, but falls to 1V when you make a noise. A fall to around 4V is normally enough to trigger the timer of the Nightlight.

To connect this circuit to the Nightlight, run a wire from the circuit's output to the terminal pin on the Nightlight board that connects to pin 6 of the IC. Remove the pull-up 10k resistor (R1 on the Nightlight board) as this prevents the sound trigger from delivering a sufficiently low pulse to the timer.

If you want to experiment with reducing sensitivity, try wiring a 100k resistor (or thereabouts) in place of the 1M resistor R7. You can remove SW1 from the Nightlight, or leave it there to provide dual control.

Other ideas

The Nightlight circuit uses a triggered timer to produce an output lasting, say, 10 minutes. You could reduce the value of its timing capacitors to obtain shorter ON periods suitable for a porch or corridor light. The two-step action warns people that the lamps will soon both be out, so it avoids leaving someone in the dark.

There are other possibilities, such as using the trigger in a security system to sound a siren. But this needs a reasonably intelligent circuit to avoid false alarms. This is something we will look at in a later issue. ❖

Parts List

Resistors

(all 5% 1/4 watt)

R1	2.2k
R2, R5	270k
R3, R6	56k
R4, R7	10k
R8	18k
R9	1M

Capacitors

C1, C2	10nF MKT or polyester
C3	22nF MKT or polyester
C4	0.22uF MKT or polyester
C5	0.1uF MKT or polyester

Semiconductors

D1, D2	1N4148 or similar
Q1,Q2	MPSA14 Darlington NPN transistor or equiv.
Q3	BC548 NPN transistor

Miscellaneous

MIC1 Electret microphone insert

Stripboard 25 mm x 85 mm (9 strips x 32 holes), 3 x 1mm terminal pins.

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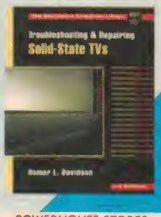

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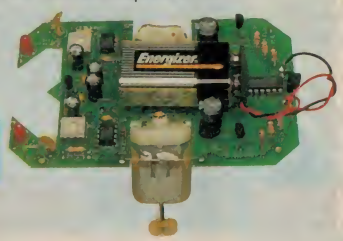
K 3560



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EA Mar '99

NEW

Digital Trigger Adaptor, MkII

- An updated version of the 1995 Digital Trigger Adaptor, utilising a complex programmable logic device (CPLD)
- The adaptor, when connected to a CRO, will trigger the scope when all relevant input conditions are met.
- Eight inputs (expandable up to 24 with slave units)
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EA Feb '99

This kit does not include a CPLD chip. Read on...

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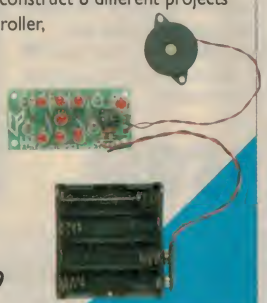
- On-board IC lets you construct 8 different projects including a timer, dice roller, mini alarm and more
- Includes buzzer, LED, programmed IC and all components
- Power supply: 3V DC

K 3167



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- Measures voltage drop across battery negative strap
- 10 LEDs to indicate level or charge or discharge
- Displays levels between -25A and 25A at 12V
- Use to monitor the state of charge of the battery to control accessory loads, etc
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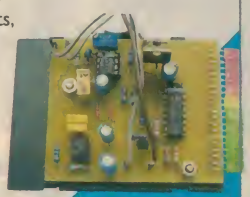
- Includes all components, case and PCB

K 4612



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- Timer circuit that utilises the feature of the Stamp Microcontroller
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- Multiple inputs for design flexibility
- Includes relay, components and a multi-purpose PCB
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- Compact, easy to install and extremely effective
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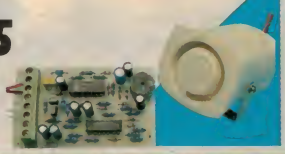
- Circuit includes transition sensitive triggers
- Power supply: 12V DC
- Includes all components, piezo siren, PCB and case.

K 4301



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EA Oct '98

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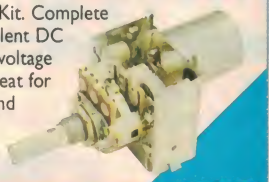

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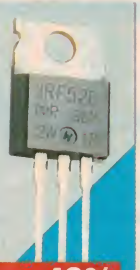

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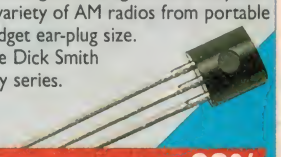

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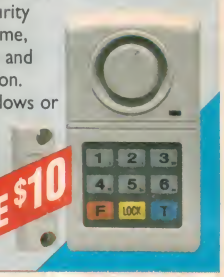

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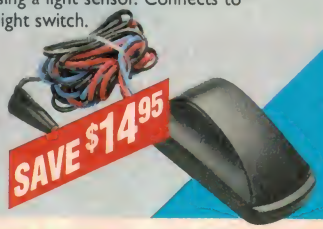

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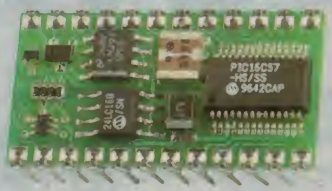

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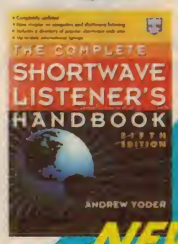

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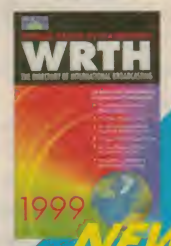

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That's where you go!

Construction Project

32 Channel, 100MS/s Digital Logic Analyser - 1

Here is the first of two articles presenting what is almost certainly the most complex project design we've ever published: a high performance logic analyser which provides 32 input channels and samples at up to 100 megasamples/second. It's free-standing, using a low cost computer monitor for the display, and can also drive a printer or download captured data to a PC.

by Peter Baxter

HAVE YOU EVER been unable to locate the cause of a problem in a microcomputer project, and wished you had equipment that would help you? Do you ever want to see what is really happening on your computer bus? Do you wish you could have a really good piece of test equipment for digital analysis?

If you answered 'yes' to any of these questions, then this Logic Analyser project is for you!

A Logic Analyser is simply an oscilloscope for computers. The main difference is that Logic Analysers have a lot more input channels, but each channel is only capable of dealing with two digital signal levels: 1 or 0.

At present, microprocessors are taking over the world. They are getting into virtually every aspect of our lives. Absolute penetration of computers is so far off that it isn't even worth considering. Opportunities will continue opening up, and many of us will be there to benefit from it. Even in *Electronics Australia*, there have been many interesting and clever microprocessor and programmable logic based projects appear over the years. This certainly isn't about to stop.

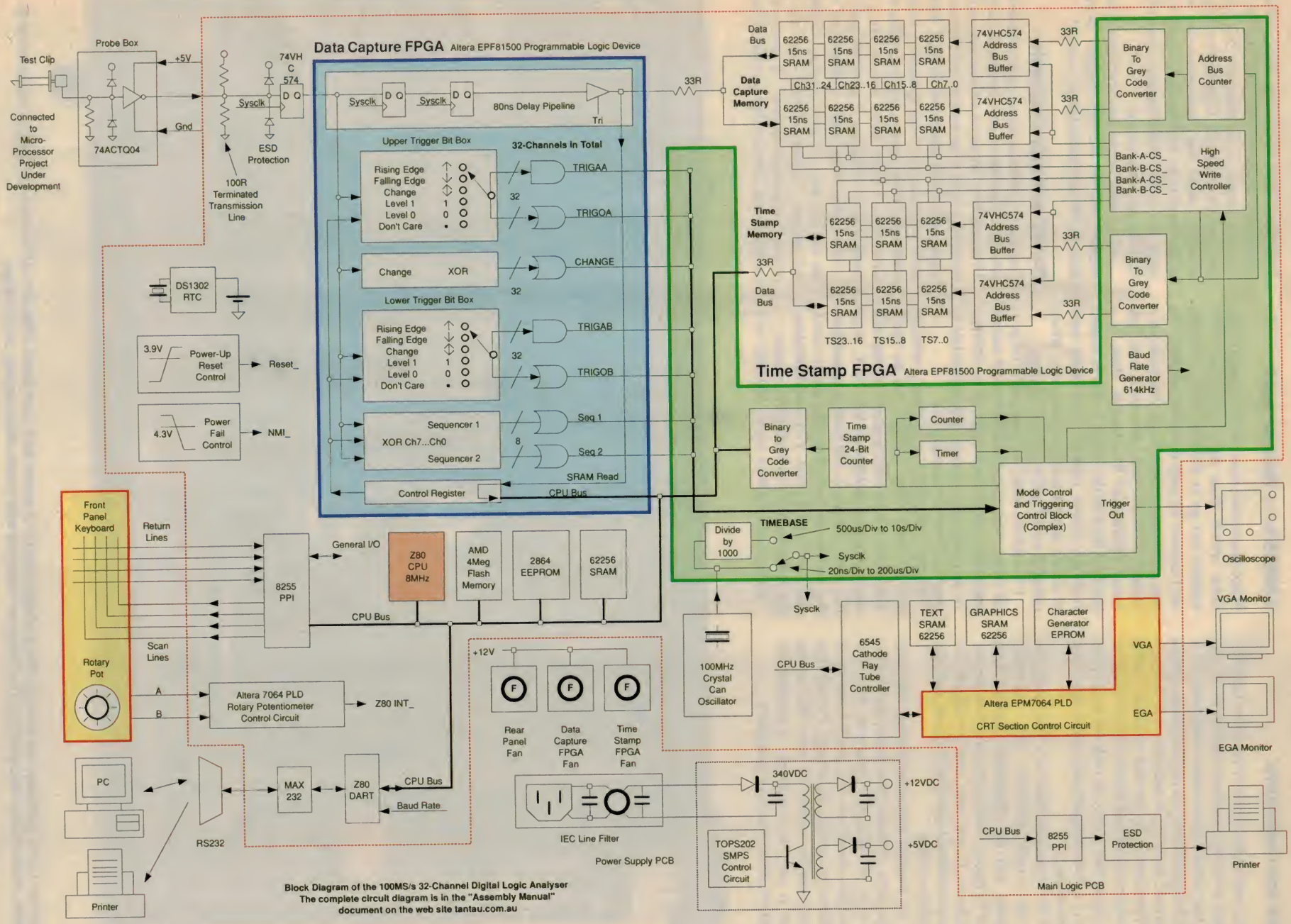
While most electronics designers have an oscilloscope and a PC, the one item that they could really benefit from is a Logic Analyser. Unfortunately, due to their costs, Logic Analysers are expensive items. Workbench analysers from firms like Hewlett-Packard and Tektronix start from about $5000 and go up. Yes, they are magnificent — but for most of us that kind of cost is hard to justify.

I set out to design a Logic Analyser that would cost about the same as a 100MHz Oscilloscope. It had to operate at 100MHz, have 32 channels, and be simple enough for most people to be able to use. I also wanted to make it a kit, to keep the costs down.

One of the author's prototype Logic Analysers, with a VGA monitor used for its display. The probe box is hooked up here to a small microcomputer board. At right is a detailed block diagram for the Analyser, to help you in understanding its operation.

What I present to you here, then, is the result of five years of design work. I originally thought that a Logic Analyser design might be fairly simple. The concept might sound simple, however its implementation is not! I've seen design attempts that show how the designers had no appreciation of signal integrity, EMC, ESD and high speed design.

One of the main failings is in the PCB. It's the part that never appears on the schematic, yet it's the most expensive single part in this design and a lot of other designs! (PCs, for instance.) You just can't run digital signals at 25MHz and above on double sided PCBs with any integrity. The ground currents want to find the path of least inductance back to the ground point. Daisy chained power and ground lines will oscillate every time ICs are hit by signals with fast edges. The thin copper traces (inductors) combined with the bypass capacitors will RING. The solid low resistance, low impedance, high capacitance ground planes in multilayer PCBs *must* be used. There are plenty of books available now that deal with this topic.



Block Diagram of the 100MS/s 32-Channel Digital Logic Analyser
The complete circuit diagram is in the "Assembly Manual" document on the web site tantau.com.au

Not for beginners

This may well be one of the most sophisticated electronic projects published in any of the world's electronics magazines. It is not designed to be simple and cheap. It was designed to do a job and do it well. I wanted to present a project that would be useful to whomever would want to use it. It had to be right, that's why it took so long. Like you, I am an engineer and I guess that's the way we are!

What is presented here is a basic overview of the Logic Analyser. The Assembly Manual and the Operations Manual total over 90 pages, which is far too much for any magazine. In any case, that's available for you to download and view from my web site should you wish.

I've divided this presentation into two main parts. Part one talks about the technical side of the Logic Analyser. Part two then talks about how it's used. I also have a follow-up article discussing the off-line power supply, which *EA* may like to run later; it may be of interest to readers for other projects, due to its simplicity.

100MS/s — fast or not?

Many microprocessors operate at pretty high clock speeds these days. The latest 8051 variants can go at 40MHz, while 266MHz isn't unusual for your Pentium computer. As you will want to use a Logic Analyser on a variety of circuits, you will want it to be fast. Using commercial ICs, though, there is a practical limit to the speed, which is around 100MHz. Above 100MHz, you really need to design application-specific IC sets, which optimise signal paths and logic delays.

I wanted the Analyser to be useful for people using 8-bit microprocessors and microcontrollers, with clock rates up to 50MHz. To be useful and accurate, I therefore had to target a 100MHz sampling rate.

50MHz sampling is a relatively straightforward task; 15ns SRAMs can be used. There are few ground bounce, timing and signal integrity problems. Most 74HC logic ICs easily handle it. But having an analyser that isn't much faster than your system clock speed isn't much good. You would get aliasing problems and misleading information.

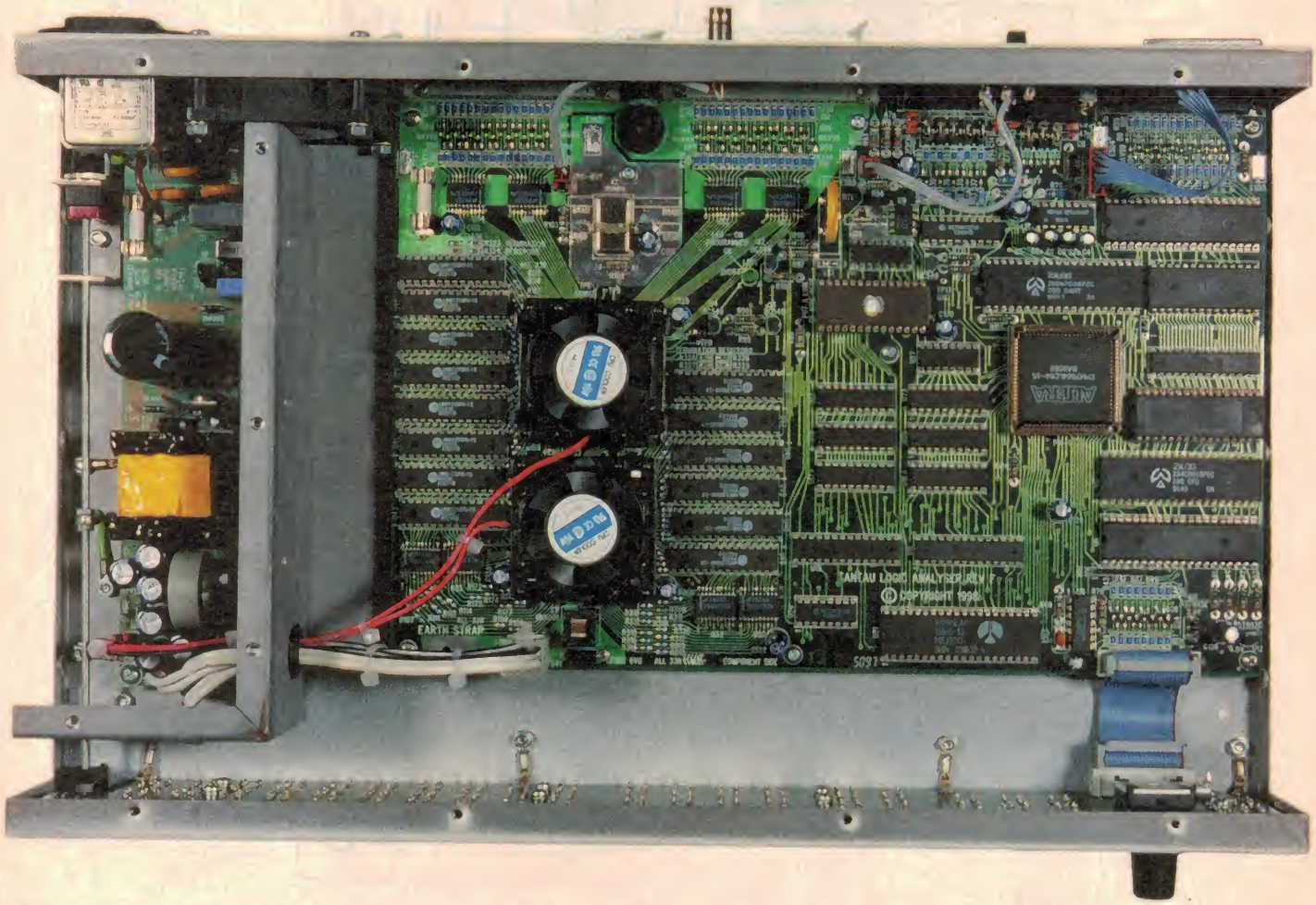
Going from 50MHz up to 100MHz is a huge leap. Dual alternating banks of high speed memory have to be used. Higher performance logic IC families (ACTQ, VHC) have to be considered. Signal reflections on data lines mean that transmission line techniques need to be implemented. Every bit of logic has to be synchronously clocked, to keep the timing accurate.

All of these measures have been implemented, and the Analyser happily samples data, at 100 megasamples per second!

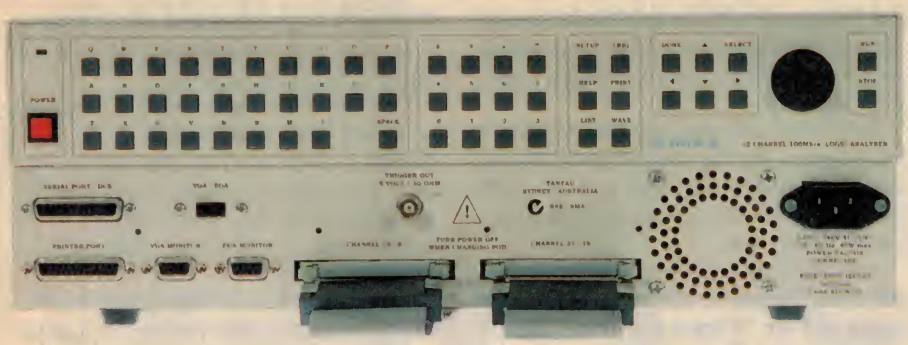
Never enough channels

Having 32 channels allows eight channels to sit on the data bus of your system under test, 16 channels to sit on its address bus and the remaining eight to be shared between control signals and other signals of interest. This is quite adequate for 8-bit systems. I haven't dealt with 16-bit systems, however those who *have* will no doubt know how to use a 32-channel Logic Analyser to get good results.

We always want more channels, so that we can see more of what's going on inside our projects. However in this case, and for practical economic reasons, 32 channels is our limit. The way you can get around this is



Inside the Logic Analyser, the two big Altera chips have CPU cooler fans over them. With 60% of the internal logic being clocked at 100MHz, these chips need cooling. The PCBs are supplied with these chips already soldered on.



Two Analysers stacked, to show the front (top) and rear panels. The two 40-way flat cables connecting to the probe boxes must have EMI ferrite clamps to reduce the 200MHz (2nd harmonic of 100MHz) RF noise, radiating out from the cable. The Trigger Out signal can be used to trigger a DSO.

by using the triggering capabilities to really focus in on what you want to see. We'll talk about that in part 2.

Where's the display?

A lot of test equipment projects these days tend to be PC cards inside computers. This sort of test equipment definitely has its place in labs and production environments, where there are lots of PCs permanently set up to monitor specific tasks and processes. It is however, not the place for Multimeters, Oscilliscopes and Logic Analysers. These are all benchtop devices that often use a PC to control a device or project that they will test. I'm often being told "Don't make it a PC card!" It's not.

I wanted to make the Logic Analyser completely independent of a PC (and Windows...). This then meant that I'd need to find a display device. If I had designed a CRT module into the Analyser, it may well have added another $500 to the cost because of the extra weight, size, aesthetic requirements and actual cost of the display. I always wanted to use a PC monitor as they are easy to obtain.

In fact, you'll notice that I use a nice new, fancy VGA monitor in all of the photos. However, I had to borrow it! I developed the whole project on junky old 640 x 480 VGA monitors that people threw out — because they had bought newer, bigger, faster, higher resolution monitors. You will even notice that the unit has an EGA monitor facility, because when I started the project (so many years ago), EGA monitors were so easy to get hold of.

Why it's expensive

OK, the next question you're going to ask is why this Logic Analyser is so much more expensive than other projects. The answer is: because it's fast!

For instance, the one part you'll never find on the circuit diagram is the printed circuit board. The four-layer Main Logic PCB costs over $100 each. Logic projects working above 20MHz have to have multilayer PCBs with separate layers for power and ground distribution. Don't think you can get away without them. If you don't have a solid, low impedance grounding system, and good power supply bypassing, you can't possibly trust high speed signals to propagate across the board with any integrity. There are now a lot of good books devoted to to good PCB design, as I mentioned earlier.

Further big-ticket items are the two big Altera EPF81500 240-pin Field Programmable Gate Arrays, at about $80 each. These devices clock signals through at 100MHz, and do all of the clever work associated with triggering. It took two years to develop the design inside them. As signals have to be fast, the circuit design and the layout inside these parts had to be optimised for speed. Forget auto-routers; the best routers are our brains. These FPGAs make the Logic Analyser possible!

Fast memory isn't cheap. There are fourteen 15ns 62256 SRAMs in the Analyser, for storing the Acquired Data and a Time Stamp. Due to speed requirements, these SRAMs are organised in two alternating banks so that signals 10ns apart will be accurately captured. The 15ns SRAMs aren't clocked on their 'WR-bar' signals, which cycle at 15ns, but on their 'CS-bar' signals which cycle at 10ns!

Hard to build?

Next question: is the Logic Analyser difficult to build? Not for anyone who has built a few kits. All of the PCBs have clearly labelled component overlays which have the component values marked. The Main Logic PCB is now revision G and any assembly problems have been sorted out. If you have built a few kits, you should be able build this one without trouble.

Mind you, if you're a beginner, the kit is really not for you. Go for the built-up version.

There are surface mount resistors, capacitors and ICs on the boards, which frighten some people due to unfamiliarity. SMD components are very easy to solder. All that is needed is a fine soldering iron tip and tweezers. Put a mul-

timeter on the ends of a SMD resistor and it still reads ohms like a leaded resistor. I suggest that you build the two Probe PCBs first to gain experience before tackling the big board. You will master it pretty quickly.

How it works

Because this is a very complex project, I'm not attempting to give a fully detailed circuit description here; it would take up half the magazine. Instead, *EA*'s editor has suggested that I give a description at the 'block diagram' level, to give you a good overall idea. Those who want to can download the manuals and go into it all in greater depth.

The circuit is divided into two basic blocks. The first part is the CPU section, which is basically just a dedicated computer that 'runs the show'. The second part, the Data Acquisition section, does everything associated with the actual capturing and storing of 32-channels of input data.

The CPU section is based around a Z80 CPU. There is a Z80 DART for RS232 communications, and two 8255 PPI's for the keyboard, printer and general I/O requirements. Program memory is in a 4MB FLASH memory, so that operating system software (and FPGA configuration files) can be upgraded by the user. A Dallas DS1302 Real Time Clock is used for time keeping.

A major part of the CPU section is the video display driver. This is based upon a Rockwell R6545 cathode-ray tube controller IC, which allows both block text and (pixel) graphics to be displayed on an external VGA or EGA monitor. Finally, an Altera MAX7064 Programmable Logic Device is used for glue logic and parts of the screen display logic.

Data acquisition

The Data Acquisition section is the sophisticated part of the Analyser. It does everything associated with acquiring the 32 channels of high speed data and storing it in SRAM. This section is based around two Altera EPF81500 FPGAs.

The first FPGA is called the 'Data Capture' FPGA, as it processes all of the data coming in from your circuit under test. It analyses all 32 channels, looking for possible trigger conditions, which are passed on to the Time Stamp FPGA. As it takes up to 80ns to process a potential Trigger Condition, the Data Capture FPGA also pipelines/delays the 32-channels of data for 80ns, before outputting the data to the SRAMs.

The second FPGA is called the 'Time Stamp' FPGA. Internally, it has a 100MHz counter that is used as the 'Time Stamp', and fed out to the Time Stamp SRAM. Whenever the 32 channels of Captured Data are stored, so too is the Time Stamp. (By 'Time Stamp' we mean a 100MHz, 24-bit counter's output, not real time.)

This FPGA also has two sets of address bus counters, for the dual banks of SRAM. The dual banks alternate and give the SRAM's address bus time to stabilise, before storing data.

Also fed to the Time Stamp FPGA from the Data Capture FPGA are the 'Change' signal and the 'Trigger Condition' signals. Whenever the Change signal is detected, Captured Data and the Time Stamp are stored. Captured Data is not stored at a regular sampling interval as this is wasteful of memory, and very inefficient when it comes to re-displaying the data. Data is only stored when there has been a change in the data on any of the 32 input channels.

The Trigger Condition signals, which are input to the Time Stamp FPGA, determine whether the Logic Analyser will trigger or not. This is dependant upon the current Trigger Mode being used. The triggering capabilities also include a 23-bit Timer and 23-bit Counter as well as the ability to trigger on a sequence of events. This triggering flexibility makes the Logic Analyser quite powerful.

While this FPGA description may sound simple, the design was not. Getting signals to propagate quickly through subsections and arrive at the right place at the right time was quite a challenge. Signal lines needed to be terminated to prevent signal reflections. Measures needed to be taken to reduce the possibility of ground bounce. At 100MHz, these things are a must!

Operating sequence

So what happens when you press RUN, to start capturing data?

The 24-bit Time Stamp clock starts rolling. The Data Capture section then sits there, waiting for something to happen on any of its 32 inputs. When something does happen, such as a change in a level (from a 0 to a 1), a 'CHANGE' signal passes through a 32-input OR gate (because it's looking for changes on all 32 channels at once), and then into the Time Stamp section.

This CHANGE signal forces the Analyser to record the Time Stamp's time at that instant, as well as all 32 channels of input data. So there is a record of the time the event happened, as well as all the input data, at that moment. All of this information is stored in Fast SRAM.

While input data is being stored, the Data Capture section is also looking for a trigger condition to be met. For instance, say we want to trigger when your project's data bus has 3F hex on it and the data bus is connected to the Logic Analyser's Channels 7..0. When the conditions on each of the 32 channels has been met, the results are ANDed to give us a TRIGAA signal. (We 'AND' because we need all eight bits to match, not just one bit, to match 3F hex.)

Inside the Time Stamp section, this TRIGAA trigger signal forces the Time Stamp and the current SRAM address to be stored. This trigger point is the reference information that all data extraction will be based around. It also starts a timer which allows the Analyser to continue recording data for a short while, before stopping data acquisition. If you didn't allow it to time out, the system might start over-writing previously stored 'valid' data.

This timer is a last resort because normally, the Analyser stops recording data when a certain number of Fast SRAM address locations have been filled. With CPU buses, this happens pretty quickly and the timer is not needed.

Once data acquisition stops, the data must be extracted and displayed on the screen. Knowing the trigger 'Time', its address, as well as the timebase range, the software determines what the 'Time' would be, at the left hand and right hand edges of the video screen. It then uses successive approximation (using the Time Stamp) to jump through all of the data to find the address of those screen edges. Knowing the time and address of each edge of the screen, the software then extracts the data and displays the waveforms on the screen.

Obviously it's much more complex that that, but this should give you a general idea of how it works. If you'd like to go deeper into the Analyser's operation, the Assembly Manual on my web site covers all of the hardware in much greater depth. In the second of these articles, we'll look at how you use the Logic Analyser.

(To be Continued.) ❖

Kits, more Information

Kits for the Logic Analyser described in this article are available from the author at:

Tantau Australia
PO Box 1232,
Lane Cove NSW 1595.
Phone (02) 9878-4715
Fax (02) 9888-7679
email **peter.baxter@tantau.com.au**

The normal cost of a complete Logic Analyser kit is A$1275 within Australia, or A$1300 in New Zealand. The Analyser is also available in fully assembled and tested form, for A$1725 (Australia) or A$1750 (New Zealand). However as a special offer for *EA* readers, the price for February and March 1999 will be A$750 and A$1250 (assembled and tested) in Australia and respectively A$800 and A$1300 in New Zealand.

More information on the Logic Analyser is also available from the author's web site at:

http://www.tantau.com.au

The website also allows you to download the complete manuals for the Analyser.

DSE's kit for the Signal Power Switch

Every now and then we have an opportunity to take a look at how *EA* projects appear in kit form, when put together by resellers such as Dick Smith Electronics. DSE recently sent us a built-up version of their Signal Power Switch kit for assessment, and as always, we were pretty keen to check it out...

ORIGINALLY PRESENTED in the October 1998 issue of Electronics Australia, our Signal-controlled Mains Power Switch is a relatively simple box of tricks that switches on its 240V AC outlet when an audio signal appears at its input. When installed in a home audio-visual setup for example, it can automatically power up amplifiers, television receivers, and a host on other peripheral gear when a 'main' signal source is activated.

This in turn means that at the touch of a remote control button (say, turning on a VCR or CD player), a raft of associated gear can also spring to life, then automatically shut down again when that main unit is turned off. The Signal Power Switch also has two audio inputs to increase its flexibility, and features a 12-second signal lockout period to prevent the possibility of cyclic self-triggering.

We're happy to say that many constructors have found this an attractive idea, and it appears that a substantial number of the units have been built up. The DSE kit we're taking a look at here appears to be an excellent way of getting one of your own, since in usual DSE fashion, the kit is of a very high quality indeed.

As you can see from the picture the DSE version of the Power Switch is in a larger case than our original. It also features a full-length earthing plate in the bottom of the case plus a number of other added safety features. Understandably, DSE are very conscious of safety issues when 240V AC mains voltages are present in project kits, and their kit department appear to have taken a considerable amount of effort in this regard.

The safety aspects that you can't see in the photo are also worth mentioning. These are metal front and rear box panels, extra bottom plate to rear panel grounding links, plus sheets of insulating material for the mains terminal strip and PCB. They've even included a suitable voltage warning sticker, and we believe that the supplied kit instruction sheets have additional wiring and safety information.

Along with the physical changes, DSE have also reduced the value of R9 from 10k to 3.3k so the signal sensitivity adjustment (RV1) is less touchy, and have repositioned the PCB's relay (RLA1) slightly to enhance electrical isolation. Both the components and printed circuit board are of a high quality, by the way, so reliability of the unit shouldn't be an issue.

All in all, we'd have to say that the modifications made by DSE should have a beneficial effect, and considering that they've kept the kit price down to $69.95 it represents very good value for money indeed.

It's also worth noting that many of the parts used in the DSE kit are significantly more expensive than those in our prototype unit, so that final kit price is a credit to DSE's committment to both magazine kits and safety.

You can find a DSE Signal Power Switch kit at your nearest Dick Smith Electronics store, or if you'd like to know more about the project itself, you can find the full article in the October 1998 issue of *Electronics Australia*. (R.E.) ❖

Computer Clinic

Installation woes, supercooled CPUs, keeping tabs on the Registry and more!

BIOS ex machina

I recently upgraded my 75MHz system with a new motherboard and a 233MHz MMX CPU. I also added 16MB of RAM, to make a total of 32MB. Now I can't seem to reinstall Windows 95. I installed Windows 3.1 from the original install floppies, and that works OK, but the trouble starts when I run SETUP off the Windows 95 CD. The setup program starts up OK, but about a minute into the install, the whole system freezes up, forcing me to reboot. I tried it again, with the same result. Everything else seems to work OK, and all the diagnostics I've run don't find any problems. Any ideas? (N. Joyce, by email)

There are a couple of things that could cause this, from a dirty or scratched CD to a rogue TSR program getting in the way. Give your CD a wash, and check your startup files if you like, but what this sounds like to me is the BIOS virus protection messing things up.

Modern BIOSes have a very reassuring anti-virus scheme built in that detects any attempts to re-write the boot sector of your hard drive, and puts a stop to it oh-so-subtly, by immediately halting the system. Unfortunately, not having a degree in advanced metaphysics, it can't tell the difference between Windows 95 and a horrible system-eating Trojan horse... When the Win95 setup goes to install its own boot sector, the BIOS comes to the rescue, and hangs your system in an attempt to save you from this awful fate.

To prevent this from happening, enter your CMOS setup next time you reboot (usually DEL or F1, it should tell you on the bootup screen), look for the Virus Protection setting, and disable it. Save and exit, and Win95 should install with no problems.

By the way, there's no need to actually install Windows 3.1 to install the upgrade version of Windows 95. All that is required is that you show that you have a copy. Simply run the Win95 setup program from DOS, and insert disk 1 of Windows 3.1 into the floppy drive. The setup program will find it and continue with the install as normal. As well as saving time, this makes for a cleaner install, as you don't have all those useless 3.1 files cluttering things up.

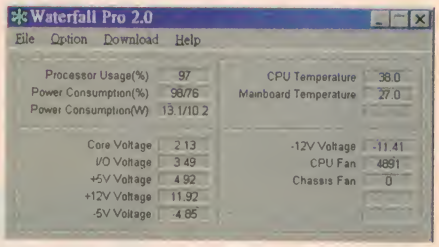
Another useful thing to do is to copy the WIN95 directory on the CD onto your hard drive (best rename it to CABS or SOURCE or something to avoid confusing it with your Windows 95 directory), and run the SETUP program from there instead of from the CD.

This takes about 75MB of disk space, but has two major advantages: it's a lot faster than installing from the CD, and Win95 will look on your hard drive next time it needs to use the installation files. This means that next time you make a change to your system, Windows can find the files it needs straight away, and you'll never see the 'Please insert the Windows 95 CD-ROM' requester again. This convenience more than pays for the disk space it takes up, and it even saves wear and tear on your CD.

Frozen chips

You recently mentioned Waterfall, a program which executes the HLT instruction in the idle thread of Windows. While I'm not familiar with that particular program, I have been using a similar applet called CPUidle, which is freeware. I can verify that it makes a huge difference to the running temperature of both the Intel P200 MMX and the Cyrix MII 300 that I've tried it with. The Cyrix when idle produces almost no heat at all — even the voltage regulators become cold to the touch. The Intel, while not responding quite so well to the idle treatment, also demonstrated a worthwhile drop in temperature. (Colin Burchall, by email)

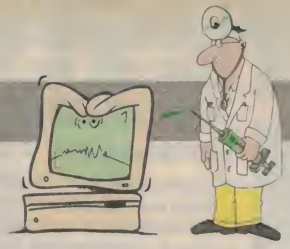
They certainly do work, don't they? Since I wrote that column, I've had a chance to play with a couple of the cooling utilities, and even better, I got to have a go with the nifty infrared thermometer reviewed in February's issue of *EA*. Running Windows 95 with no active tasks, my AMD K6-2 300MHz CPU ran at about 43°. Both CPUidle (**http://www.stud.uni-hannover.de/~goetz**) and Waterfall (**http://cpu.simplenet.com/leading_win-tech**) took the idle temperature down to about 35°. Under heavy CPU load (Quake 2 at 1024 x 768, using software rendering), the temperature rose back to about 43°, with or without any cooling software running.



On a related note, back in the May 98 issue I talked about overclocking and some of the fancier CPU cooling devices available, namely Peltier effect CPU coolers which use a powered thermocouple to drive heat away from the chip. These are extremely effective, but if you're thinking of using one, be careful. As it turns out, they can actually cool your CPU so effectively that it becomes colder than the surrounding air, especially when used in conjunction with software cooling utilities. This might sound like a good thing, but if your CPU gets *too* cold, moisture from the air condenses onto the chip, shorting out pins, corroding PCB tracks and generally causing havoc.

This may sound like an urban myth, but if you don't believe me, check out some pictures of dew-borne devastation at **http://www.stud.uni-hannover.de/~goetz/toocool.htm**.

At this point, I'd just like to restate that if anyone is thinking of overclocking their CPU, they should remember that all in all, overclocking is a bad idea; it can considerably reduce the life expectancy of your CPU and produce some really bizarre and hard-to-track-down bugs. If you really need the extra speed, shell out for more RAM or a new processor, or try to reduce the amount of RAM and processor time being eaten by things like Active Desktop and large background pictures. You'll get a faster, more reliable system that isn't going to die on you.



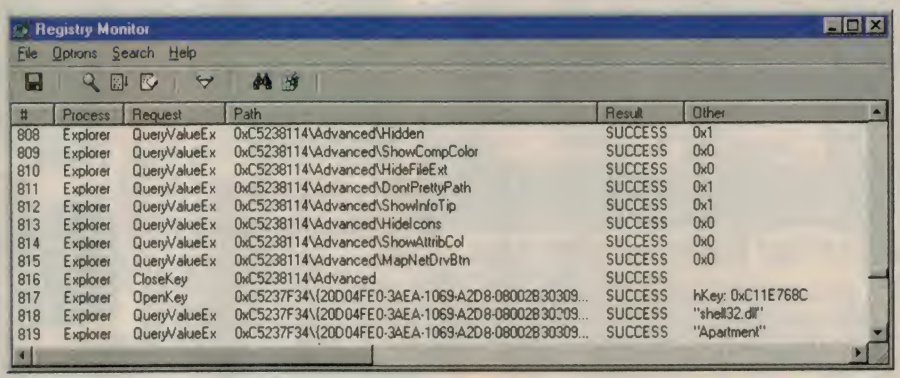
Got any computer queries? Whatever is bugging you, from hardware problems to C programming, send it in and we'll soon have you fixed up. You can email your question to electaus@magna.com.au, or fax or mail it in to us here at EA.

Medium rare

In the December 98 issue of Webwatch, Graham Cattley (any relation?) [*Yes — JBC*] mentioned Winamp as the best player for MP3 files, but I think you should know that the new version of the Windows Media Player handles MP3s, and virtually every other multimedia file type as well, all in one package. Why bother with anything else? (Peter Allsworth, by email)

Although the new Media Player will handle MP3, the various video formats, and pretty much anything else you care to throw at it, Winamp does still have its advantages, however. Winamp is more configurable than Media player, and gives you a choice of codecs and more detailed playback settings. Also, I have heard that there are some MP3s that Media Player won't play, though I have yet to confirm this.

Last but not least, Winamp is also a lot more fun to use, with a very cool user interface, and it makes a change from Yet Another Microsoft Product. Why not get the best of both worlds, and install both? You can get Winamp from **http://www.winamp.com**, and Media Player from **http://www.microsoft.com/mediaplayer**.



#	Process	Request	Path	Result	Other
808	Explorer	QueryValueEx	0xC5238114\Advanced\Hidden	SUCCESS	0x1
809	Explorer	QueryValueEx	0xC5238114\Advanced\ShowCompColor	SUCCESS	0x0
810	Explorer	QueryValueEx	0xC5238114\Advanced\HideFileExt	SUCCESS	0x0
811	Explorer	QueryValueEx	0xC5238114\Advanced\DontPrettyPath	SUCCESS	0x1
812	Explorer	QueryValueEx	0xC5238114\Advanced\ShowInfoTip	SUCCESS	0x1
813	Explorer	QueryValueEx	0xC5238114\Advanced\HideIcons	SUCCESS	0x0
814	Explorer	QueryValueEx	0xC5238114\Advanced\ShowAttribCol	SUCCESS	0x0
815	Explorer	QueryValueEx	0xC5238114\Advanced\MapNetDrvBtn	SUCCESS	0x0
816	Explorer	CloseKey	0xC5238114\Advanced	SUCCESS	
817	Explorer	OpenKey	0xC5237F34\{20D04FE0-3AEA-1069-A2D8-08002B30309...	SUCCESS	hKey: 0xC11E768C
818	Explorer	QueryValueEx	0xC5237F34\{20D04FE0-3AEA-1069-A2D8-08002B30309...	SUCCESS	"shell32.dll"
819	Explorer	QueryValueEx	0xC5237F34\{20D04FE0-3AEA-1069-A2D8-08002B30309...	SUCCESS	"Apartment"

Key note

When I use Microsoft Word's on-the-fly spell checking feature, I have to keep reaching for the mouse every time I want to correct a word. Using the keyboard, I can only bring up the Spelling and Grammar menu, which is too involved to use while I'm typing. Is there a way to bring up the right-button menu without using the mouse? (Alex Buchanan, Moss Vale NSW)

Yes there is, all you have to do is hit SHIFT-F10 to bring up the right-button menu wherever the cursor is. You can then just use the cursor keys and Enter or Esc, to navigate the menu. This works throughout Win95 as well, so you can use it to access the context menus for icons as well.

Of course, you could always get one of those fancy Win95 keyboards, with the Start menu and Context Menu keys, but these can get very irritating if you occasionally miss the shift key, as I tend to do. This can be especially devastating if you're playing games such as Quake, which involve heavy use of the Shift, Alt and Ctrl keys.

Luckily, there is a workaround for this. Download the Kerneltoys collection from **http://www.microsoft.com/windows95/downloads/contents/wutoys/w95kerneltoy/default.asp**, and install the Logo Key Control, which disables the offending keys on a per-application basis.

The gory details

My software pick of the month is a pair of extremely handy little utilities called Filemon and Regmon. Designed for type 'A' personalities and developers, these programs allow you to monitor all accesses to the filesystem and the registry. Filemon allows you to filter events by process, by filename or a combination of both, so you can find out exactly which files a particular program uses, or which programs use a particular file.

This is amazingly useful for tracking down problems such as missing DLLs or software that assumes a specific directory structure, and also for generally poking around in the innards of your operating system. For example, you may not have realized that simply right-clicking on a file can result in over two hundred separate disk accesses! (The entertainment value of such information may, I understand, be somewhat limited for the less nerdish among you, but it takes all sorts...)

As you may have guessed, Regmon performs much the same function, only it works with the Registry instead of the filesystem. If you've ever had a program that refuses to change or clear its stored settings, or you simply want to know where it's getting a particular piece of information, this is the utility for you.

Regmon also has a neat little feature that allows you to edit a key (using regedit) simply by clicking on it in the Regmon window, so you can quickly and simply deal with any offending keys the moment you see them. (Having used the words 'edit' and 'Registry' in the same paragraph, I am of course obliged to abjure you to back up your registry first, but we all know that by now, don't we?)

Even if you never really use these programs for anything constructive, they can teach you an awful lot about the internal workings of your OS. Best of all, they're freeware, so go grab a copy at **http://www.sysinternals.com**, and start hacking! ❖

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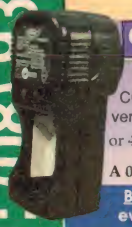
Jack O'Donnell, Managing Director



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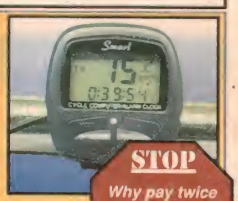
Ideal for use in hydroponics, garden centres, shade houses, monitoring air conditioning , aquariums, wine cellars, etc.

LCD Bike Computer



A must for serious cyclists!
Features: • Current Speed • Average Speed • Maximum Speed • Trip Time • Trip Distance • Total Distance (Odometer) • 24Hr Clock Time • Countdown Timer • Countdown Distance. Supplied with mounting brackets, magnetic pickup, spoke magnet, even the battery! **(Valued at $3.95)**

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FANTASTIC FOR BOATING, CAMPING, CARAVANS, REMOTE AREA POWER SYSTEMS, RECREATION VEHICLES & 4WDs

Part No	Power (Watts)	Weight (Kgs)	Dimensions(mm) H	W	D	RRP
N 1005	5	0.77	250	269	23	$160
N 1010	10	1.5	420	269	23	$195
N 1020	20	2.5	416	500	23	$290
N 1030	32	3.5	588	660	23	$350
N 1050	53	5.5	933	660	23	$515
N 1080	80	9.5	1105	660	50	$745

*Power rating are quoted at STC of 1000 W/m2 & 25 °C cell temperature

6.5A Solar Panel Regulator

Most photovoltaic panels require an external regulator to avoid the overcharging of batteries. Features: • Reverse polarity protection • Temperature compensation • *PWM* Pulse Width Modulation charging • LED charging indicator and is housed in a rugged all aluminium case • Encapsulated in epoxy for a durable weather resistant seal to suit any conditions. • 5 Year Warranty

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This system is the same type used by commercial alarm companies.
This alarm can be configured to automatically dial two preset numbers in the event of an alarm. The entire system is controlled and programmed via a keypad.

S 5490 **$299**

Features
- 4 User Codes
- System test function
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- Silent Alarm
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Famous Australian Made NESS Quantum PIR

Features: • Small size • User Selectable Pulse Count On-Off• Dual Element Pyroelectric Sensor • Surface or corner mounting • N.C. Alarm contacts in standby condition • Tamper switch • Adjustable Beam Height Angle • Single pulse or triple count • Exceptional RFI and ESD immunity

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S 5305 Last Year $49, NOW **$39** this month only when purchased with the above DSC system.
Buy 2 for ONLY $65!

Laser Pointer

This stylish slimline laser pointer is about the same size as a fountain pen, and includes a pocket clip. Excellent for lectures, guided tours, seminars,building sites. Push-to-activate operation. Power output is limited to 1mW (Requirement by law)Uses two AAA cells (included!). *Supplied with soft leatherette storage case.*

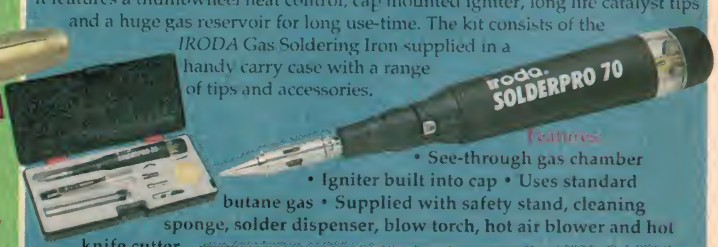
NEW IMPROVED MODEL

A 0202 **$45**

NEW LOW PRICE FOR 1999!

Gas Powered Soldering Irons

The advanced *IRODA* Soldering Iron offers go-anywhere soldering convenience. It features a thumbwheel heat control, cap mounted igniter, long life catalyst tips and a huge gas reservoir for long use-time. The kit consists of the *IRODA* Gas Soldering Iron supplied in a handy carry case with a range of tips and accessories.



Features: • See-through gas chamber • Igniter built into cap • Uses standard butane gas • Supplied with safety stand, cleaning sponge, solder dispenser, blow torch, hot air blower and hot knife cutter

T 2592 Complete Kit with Accessories, Normally $79.95 *THIS MONTH ONLY* **$69.95**
T 2590 Gas Iron plus Blow Torch Tip, Normally $49.95 *THIS MONTH ONLY* **$39.95**

SUPER BONUS OFFER! *The first 100 callers to purchase either a T 2592 or T 2590 qualify for our FREE bonus offer of a roll of T 1100A solder and a T 2449 Butane Refill, together valued at $10.45 ABSOLUTELY FREE!!*

1-800 999 007 PERTH (08) 9328 1599

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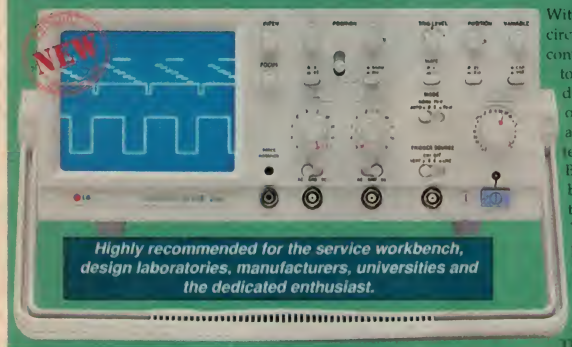
LG Precision 20MHz Dual Trace Dual Beam CRO



With the increasing usage of digital circuitry and skyrocketing complexity of electronic circuits today, even in the simplest devices, a high quality oscilloscope is becoming an absolute necessity for service techs and serious enthusiasts. Built by electronic giants LG, the build quality is top shelf, with the performance to match. The high contrast 6" screen displays the observed waveform in crisp focus and intensity, ensuring you're looking at an accurate representation of the circuit under test. The vertical amplifiers have a sensitivity of a tiny 1mV/div, guaranteeing accurate response to even the smallest of input signals, and a frequency response with smooth roll off which actually exceeds 20MHz. A TV sync. signal separator circuit provides for the stable observation of video signals. Triggering can be based on an internal trigger, a signal derived from the mains line, or an external input from a sweep generator or similar.

Q 0152 ONLY **$699***

*Note: Probes not included

Probes to suit LG Q 0152 CRO and most other CROs.

Q 0174 $39.50 ea

1.5A Regulated Supply

Includes Short Circuit, Thermal & Overload Protection!

This compact sturdy power supply is capable of delivering a constant 1.5A at 3V,4.5V, 6V, 7.5V, 9V and 12V. Being regulated, the output voltage varies only minimally from full load to no load making it ideal for voltage sensitive devices like portable TV sets, video games, tape recorders, radios, scanners, computers. Features a mains on/off switch, power on indicator and binding post connections.

M 8230 Normally $49, NOW **$39.95**

NEW

Micron Soldering Station

The *MICRON* Series 3 soldering station employs electronic switch mode circuitry in lieu of a mains transformer. Excellent for all general purpose and production soldering. **Features:** • High insulation ceramic heating element • Rapid heat-up and heat recovery • Heater insulation of over 100MΩ • Zero voltage circuit minimises high voltage spikes & magnetic fields to prevent damage to sensitive devices • Continuous temperature adjustable from 250° to 430°C • Grounded power cord • Selecting the desired operating temperature is as simple as turning a knob. *Supplied with Long-Lasting Iron Clad Tip*

T 2443 Normally $149, NOW **$129**

SUPER BONUS

FREE T 1230 Twin Pk Solder Wick **PLUS** *the T 1300 Solder Roll Holder* **PLUS** *FREE Solder with every T 2443 purchased this month!! (Valued at $28.90)*

Solder Roll Holder

KEEPS YOUR SOLDER TIDY ON THE BENCH!

This handy solder dispenser accepts 200g and 1kg rolls of solder. Can be mounted on wall or bench.

T 1300 ONLY **$19.95**

INCLUDES BONUS 200g ROLL OF T1100A or T1110A SOLDER (Valued at $6.25)

True RMS Digital Multimeter

Features: • True RMS • Large display with bargraph • 10 Location memory • Min, max, average and relative modes • Pulse signal generator for logic and audible testing etc • Continuity & diode test • Logic test • Auto power "off" and "keep on" mode • 20A current range • Back lit display • Data hold and run mode • Low battery indication • Overload protection • Design in compliance with UL 1244 and VDE0411

Recommended for Professional R&D or Laboratory Applications

Specifications:

DC V:	400mV, 4V, 40V, 400V, 1000V
AC V:	4V, 40V, 400V, 750V
DC Current:	400µA, 400mA, 20A
AC Current:	400µA, 400mA, 20A
Frequency:	10kHz, 100kHz, 1MHz, 10MHz
Resistance:	400Ω, 4k, 40k, 400k, 4M, 40M
Capacitance:	100µF
Inductance:	100H
Temperature:	-17° - 1093° C (0° - 2000° F)
Display:	3.75 digit, 4000 count LCD

Q 1091 Was $279, NOW ONLY **$260**

Intelligent UHF Remote Control

This miniature intelligent *learning* remote control can be used as a replacement for your car remote control or to combine more than one remote, ie. Garage door, car, motorbike, home alarm, etc. **Features:** • Four programmable buttons • Easy to program • Wide operating frequency range of 255-500MHz • Includes alkaline battery

Put your car alarm and garage door opener on one handy remote!

A 1015 *ONLY* **$39**

1.5A Regulated Car Adaptor

Suitable for portable radio, TV, CD Player, Electronics games, calculators, etc.

Simply plugs into your car's cigarette lighter socket, and allows you to power a myriad of appliances. Includes SEVEN interchangeable tips to suit most DC power sockets. Fuse protected. All voltage settings except 12V are regulated, 1.5, 3, 4.5, 6, 7.5, 9, 12V at 1500mA.

M 8620 **$29.95**

1500W Switchmode 12V / 240V Inverter

Massive 1500 Watts Output! Ideal for Remote Home Power Systems. Will Power a wide range of appliances, including Fluoro Lights & Microwaves.

This inverter provides up to a massive *1500W* of 240V power from a heavy duty 12VDC car or truck battery. Switchmode design eliminates bulky and heavy output transformers, making this unit very lightweight compared to similar inverters. Suitable for a wide range of applications such as remote homes, sail and power boats, building or mine sites, off road vehicles, caravans, farms etc. **Features:** • Over temperature & overload shutdown • Auto fan cooling • Low battery warning & shutdown • Heavy duty leads • Twin outlets • Weighs only 3.6kgs

M 8140A Normally $995, NOW **$795**

DOUBLE BONUS OFFER!

Receive a **FREE** protective holster and temperature probe adaptor, together valued at **$36.50** with every Q 1091. That's a total saving of over $50!

1.44MB Floppy Disks

IBM Formatted Double Sided High Density 3.5" 1.44MB disks. 100% Error Free, Lifetime Warranty.

D 0100 **$12.95** Pack 25

Professional Crimping Tool

This heavy duty, all metal deluxe tool will crimp all size modular plugs from 4 to 8 way. Also has inbuilt cutters and wire stripper that strips to accurate length for plugs.

T 1570 *NEW REDUCED PRICE FOR 1999* **$159**

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Kodak Gold CD-R

Premium quality CD-Rs plus jewel case. *Beware of cheaper inferior quality products that are prone to failure.*

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SPECIAL INTRODUCTORY PRICE!

3 Button Serial Mouse

This easy to use mouse is suitable for most IBM® compatible computers. Features 3 buttons, 9 pin connector, 1.5M lead, Microsoft® Windows® compatible. Can be programmed for left handed users. Includes software.

D 2050 ONLY **$12.95**

104 Keyboard

Ergonomically designed keyboard, suitable for most IBM® compatible computers. Features: • 104 keys • 5 pin connector • 1.5M lead & Microsoft® Windows® compatible.

D 2100 **$29.95**

LAN Cable Tester Kit

This handy unit can test continuity, open/short and cross wired LAN wiring or modular leads. *Features:* • Auto/Manual Scan modes • LED indicators for all connections including Ground • Will test 10Base-T, 10Base-2,RJ45/RJ11, 258A, TIA 568A/568B and Token Ring • BNC to RJ45 Adaptor included • Includes Soft carry case

D 3010 **$169**

NEW LOW PRICE FOR 1999

Save hours of tedious fault-finding, only to find that the *wiring* is the problem!

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Charges NiCad, Ni-MH, Sealed Lead Acid, car and motorcycle batteries up to 4Ah!

A complete battery charger! Using the new, high-tech Philips TEA1102A Battery Management IC, this versatile unit charges NiCad, Nickel Metal Hydride, Sealed Lead Acid, car and motorcycle batteries from 1.2Ah to 4Ah in 6, 7.2, 9.6, 12 and 14.4V terminal voltages. It even does power tool and R/C model battery packs! Best of all, it's super fast, and can charge a 1.2Ah battery pack in just 15 minutes! The batteries are kept topped up using pulse-trickle charging once they're up to full charge, so there's no danger of overcharging your batteries. It also features a refresher for NiCd and NiMH batteries, under and over-temperature cutout, short circuit battery protection, timeout and fuse protection and LED charge indicators.

BEWARE OF INFERIOR KIT SETS! *The Altronics K 1670 is includes a professional instrument case, including fully silk-screened and punched front & rear panels. PLUS, we've specified a low-radiation, high efficiency toroidal mains transformer.*

K 1670 Normally $199, NOW ONLY **$179**

New design features the latest Motorola high power output transistors!!

HUGE 500W! Great for DJ amps, component subwoofers, instrument amplifiers, even PA systems!

500W Amplifier Module Kit

What a Beast! 500W into 4Ω!

(See SC Aug '97) Just the thing to power dedicated subwoofers, DJ, PA or party amps or the like. Silicon Chip claims it's the biggest amplifier ever published in a magazine and they'd be right. *Features* • 500W RMS into 4 ohms , 278W into 8 ohms (-0.3dB @ 20hz and 20KHz) • Input sensitivity 1.43V (at full power into 8 ohms) • Distortion typical less than 0.01% • Signal to noise 117db un-weighted 122db A-weighted • Supplied with the PCB and the components to populate the board, requires a heatsink and power supply *(requires ±80V DC)*

K 5190 Normally $230, NOW ONLY **$200**

12V Halogen Discolight Kit

(See SC Jan/Feb '98) Based on the original Silicon chip Discolight, this unit offers the same features as the mains version only with low voltage rails , making it ideal as a school project or to add something different to your car at the next car show or auto salon! Supplied with an attractive case with pre-punched and screened front panel and parts to build and power the unit off 12V DC ***(halogen lamps not supplied).***

Great for car shows, sound-offs, shop displays etc! A safe, low voltage light display!

Features: • 4 channels (20W or 50W halogen lamps) • Forward, reverse and auto reversing chaser patterns with music modulation • Simultaneous strobe on all channels • Alternating light patterns • 12V DC or AC operation • Input from loudspeakers, aux level or mic .

K 5807 Normally $159, NOW ONLY **$127**

Sustain Unit Kit for Electric Guitars

(See SC Apr '98) A sustain unit can make your guitar sound a little more "live", by keeping the volume of a note at a constant level while the string resonance dies away. It's one of the most widely used guitar effects (FX), and this simple kit is a fraction of the cost of a commercial unit! It features adjustable attack and decay, a defeat switch and standard 6.35mm input/output jack sockets. Requires a 12V DC power supply. Supplied short form so you can build it into a custom case, if required.

Add sustain to your range of guitar FX at a fraction of the cost of a commercial unit!

K 5539 **$27.95**

JFET Direct Injection Box Kit

(See EA Apr '98) DI Boxes allow you to feed the output from a musical instrument directly into an amplifier without using a mic. This new improved DI unit uses a single JFET amplifier, driving a line balancing transformer, and operates from a mixing consoles phantom power system. It has extremely low noise characteristics, high common-mode rejection and wide dynamic range. It features a 6.35mm jack input, a 6.35mm "loop out" for an instrument amplifier, and a balanced 3 pin XLR output for connection to the mixing desk.

A simple, phantom-powered DI box with super low noise JFET mixer!

K 5552 **$49.50**

Video Fader Kit

Add professional wipes & fades to your home videos! Even includes an enhancer to boost the edited signal!

(See EA April '98) Got some home videos you'd like to edit properly for keeps? This useful kit allows you to add basic professional video effects such as horizontal and vertical wipes, fade-ins and fade-outs during your editing. It also includes a built-in switchable signal enhancer so you'll maintain a high picture quality during the process. You'll be surprised just how professional-looking your results can be simply by using this very easy to build kit! Powered by 12VDC plugpack.

K 5875 Normally $65, NOW **$50**

M 9660 12V DC 300mA Plugpack **$13.50**

Cable Break Finder Kit

(See EA Feb '98) This cable break finder kit allows you to locate the discontinuity in a length of cable without cutting off inch-long sections of cable looking for it! The lead is simply plugged into the unit's sockets, then the dial is rotated until the LED lights. You can then read the location of the break, expressed as a percentage of the cable's length, off the dial. Dead easy! Tests 3 pin XLR, 6.35mm mono and RCA cables. Powered by 9V battery (not included).

Locate cable breaks in seconds!

K 2571 **$39.95**

Musical Doorbell Kit

(See SC Nov '97) A simple little kit that can add a touch of interest to your doorbell! It can be "programmed", by setting resistor values, to play a sequence of nine notes when the doorbell is pushed. Kit includes PCB, components, loudspeaker and pushbutton switch for the door button, or you may like to use your standard door bell switch if you have one already! It's powered by a 9V battery or DC plugpack (not included).

K 1145 **$18.95**

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Standard Delivery & Packing Charge: $4.00 to 500gms, $5.50 500gms-1 kg, $8.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

Overnight Jetservice: Up to 3kg is $9.50, 3kg to 5kg is $16.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

Heavy Service: All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs. **Insurance:** As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance". **Altronics Resellers:** Chances are there is an Altronics Reseller right near you—check our catalogue list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ●. These dealers generally carry a comprehensive range of Altronic products and kits.

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BUNBURY	Leading Edge Hi-Fi	(08) 97216222
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EAST MALVERN	Radio Parts ●	(03) 95718122
HUNTINGDALE	Rockby Electronics	(03) 95628559
	Stewart Electronic Comp.	(03) 95433733
NUNAWADING	Semtronics	(03) 98733555
PRESTON	Preston Electronics ●	(03) 94840191
WEST MELB.	G.B. Telespares	(03) 93266146
	Radio Parts ●	(03) 93297888

COUNTRY		
BALLARAT	Wiltronics	(03) 53311947
BENDIGO	PCB Electronics	(03) 54444044
CRANBOURNE	G & C Communications	(03) 59963298
MILDURA	Truscott Electronics ●	(03) 50238138
NEWCOMBE	Academy TV	(03) 52481621
WARRIGUL	Advantage One	(03) 56221533
WONTHAGGI	Raneye Pty Ltd	(03) 56724774
QLD - CITY	Delsound PL●	(07) 38396155
BOWEN HILLS	St.Lucia Electronics	(07) 32527466
UNDERWOOD	David Hall Elect.●	(07) 38082777
COUNTRY		
CAIRNS	Pentacom	(07) 40321710
GLADSTONE	Dtronics	(07) 49723960
	Gladstone Elect. Services	(07) 49724459
HERVEY BAY	Keller Electronics ●	(07) 41283055
MAROOCHYDORE	All Electronic Supplies ●	(07) 54436119
MARYBOROUGH	Keller Electronics ●	(07) 41214559
TOWNSVILLE	Solex ●	(07) 47754522
TAS - CITY		
HOBART	Active Electronics	(03) 62310111
LAUNCESTON	Active Electronics	(03) 63347333
NT		
ALICE SPRINGS	Farmer Electronics	(08) 89522388

SA - CITY	Aztronics ●	(08) 82126212
	Force Electronics ●	(08) 82125505
BRIGHTON	Force Electronics ●	(08) 83770512
COL LIGHT GDNS	Force Electronics ●	(08) 83743346
ENFIELD	Aztronics ●	(08) 83496340
FINDON	Force Electronics ●	(08) 83471188
HOLDEN HILL	Force Electronics ●	(08) 82617088
KENSINGTON PK	Force Electronics ●	(08) 83322299
LONSDALE	Force Electronics ●	(08) 83263331
MONTAGUE FARM	Dynamic Sound Elects	(08) 82624242
PROSPECT	Force Electronics ●	(08) 83420833
NSW - CITY	David Reid Elect. ●	(02) 92671385
SMITHFIELD	Chantronics	(02) 96097218
COUNTRY		
COFFS HARBOUR	Coffs Habour Elect.	(02) 66525684
LISMORE	Decro Electronics	(02) 66214137
NEWCASTLE	Novocastrian Elec Supplies	(02) 49562562
WAGGA WAGGA	Phillips Electronics	(02) 69216558
WARNERS BAY	Vilec Distributors	(02) 49566808
WOLLONGONG	Newtek Electronics ●	(02) 42271620
	Vimcom Electronics	(02) 42284400

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Information Centre

by Peter Phillips

Appliance problems, model planes & mains-rated caps

What sort of device is the thermostat in a modern domestic fridge: mechanical or electronic? We discuss this topic, along with model aircraft control systems, using a capacitor as a voltage dropping device and more...

I RECENTLY HAD to call a refrigerator mechanic to fix the family fridge, which had stopped working after a strong electrical storm. According to the service companies I contacted, quite a few fridges had been affected by this storm, and getting someone proved difficult. Finally a mechanic called and replaced the thermostat, pointing out that this was the 'bit' usually damaged by such a storm.

Fortunately he left the faulty thermostat, so I decided to investigate. The fridge in question (Fisher and Paykel, model N500B) is less than three years old, so I was surprised to find the thermostat was mechanical, rather than an electronic. Its only electrical part is the set of contacts, so I was intrigued to discover how lighting could have affected it.

I've photographed it, as it's unlikely many readers have had much to do with fridge thermostats, and like me, probably assume these are now electronic. As well, the photos might show the precision of this $50 component. It's a design that goes back many years, but seems to be preferred to an electronic circuit.

The thermostat has a capillary tube filled with a refrigerant that expands with an increase in temperature, causing the bellows to expand and operate a set of spring-loaded contacts — which in turn control power to the fridge compressor. According to my measurements, the thermostat operates with a temperature differential of around 5°C, centred on a temperature of 2°C or so.

I examined the device under a magnifying glass and could find no evidence of damage. It was clear the capillary had lost its 'pressure', but another mechanic I spoke to couldn't explain how this was caused by an electrical storm, pointing out that lightning damage is usually obvious.

I'm assuming that somehow lightning punctured the capillary with a hole too small to see, but enough to release its pressurised contents. If so, surely this can be prevented by housing the capillary tube appropriately. After all, I assume a mechanical thermostat is preferred because of its superior electrical ruggedness compared to an electronic controller. I welcome your comments on this, especially if you know more about these devices.

Fig.1: The thermostat from a recent model Fisher & Paykel domestic fridge.

Fig.2: View showing the contacts when removed from the thermostat.

Fig.3: This shot shows the bellows lifted from the thermostat.

Now to a subject we've not previously discussed: radio controlled servos for models.

Radio controlled servos

I've received two letters on this topic. Here's the first:

I'm inquiring about transmitters and receivers for radio controlled boats and aeroplanes. I'd like to build a transmitter small enough to be carried on a model plane or boat, to send back a signal to a small hand-held receiver with a light panel on it. The transmitter and receiver need to have two channels. Also could you tell me what sort of antenna I need for at least a 500-metre distance. (David Goldie, Adelaide, SA)

And the second letter:

Could you please tell me where I can get plans and information on how to build a remote control for model aeroplanes. (John Nixon, Palinyewah, NSW)

For starters, we published a two-part article called Projects for Radio Control Modellers, in the October and November 1994 issues. The article explains how servos and relays can be operated over a radio link, using a digital proportional radio control system, which in principle works like this:

The transmitter continually sends out a train of eight pulses, preceded by a synchronising pulse. Although there's always eight pulses (for eight channels), not all channels have to be used. Apart from the sync pulse, which is of fixed duration (typically 6ms), the length of the pulse for a channel can vary between one and two milliseconds, caused by the operator moving the corresponding control stick.

At the receiver, each sync pulse resets a counter, which then starts counting the pulses from the pulse train. This ensures the transmitter and receiver keep in synchronism with each other. The counter allows the rest of the circuit to identify which pulse is being sent by the transmitter, and passes it to the servo or device controlled by that channel.

It takes about 18ms for a complete pulse train (or frame) to be transmitted, which

means the receiver is updated around 55 times per second. The frame period varies from 14ms to 22ms, depending on whether the channel controllers are at their minimum or maximum settings. Typically, the controllers are at mid-position so the channel pulses are 1.5ms long, giving a frame period of 18ms.

Servos and other devices are therefore designed to respond to an input pulse of between 1ms and 2ms, repeated every 18ms. The output shaft of a servo moves through an angle of 90°, starting from a fully anticlockwise position when a 1ms pulse is received, and moving clockwise with increasing pulse length up to 90° at 2ms.

A servo only moves when the pulse length changes, and will move to a new position within its 90° arc of travel. The amount of rotation is proportional to the length of the pulse, in excess of 1ms. Because the motor draws current only when it's moving, servos take very little battery power. There's more to it of course, which is explained in the above-mentioned articles.

However, our letters want information about the radio link, rather than the servos, which I've described anyway to give the complete story. It seems the general opinion from those in the field (including the author of the above articles) is to *buy*, rather than try and build a transmitter and receiver. Most hobby shops stock these items (eg, Hobbyco in Sydney), and it's then up to the user to add the controllers and servos, such as those described in the articles I've mentioned. Oatley Electronics is planning a suitable 433MHz high power radio control system, which we hope to publish later this year.

Getting back to the first letter, the usual frequency for radio controlled systems for models is either in the 27MHz or 40MHz range. It's usual to have two matching crystals (receiver and transmitter), identified with colour stripes, to ensure your frequency is different to others working in the same area. Other frequencies can be used, such as 433MHz. The higher the frequency the shorter the antenna. As far as I know, the usual antenna is a dipole with a length tuned to the frequency of the system.

Regarding a transmitter and receiver you might try using David, we've published a number of articles on systems based on 304MHz. Unfortunately this frequency is also allocated for defence purposes, so the operating range of these projects is therefore limited to comply with the regulations. For example, the Four Channel Remote Control (UHF) in the March '94 issue features a very small transmitter and a ready-built receiver. However, as mentioned, Oatley Electronics is planning a 433MHz system, which might better suit your needs.

If neither of these options are suitable, then, as already suggested, you might consider buying a commercial transmitter and receiver, and building the rest of the electronics yourself.

Capacitors at 240V AC

In December I described how to calculate the value of a capacitor for use as a voltage dropping device, to power a 12V circuit directly from the mains. As this is a dicey (and dangerous) thing to do, here's two letters from readers on this topic.

In December, you mentioned using a capacitor to drop voltage. While you pointed out it does not provide galvanic isolation, you didn't mention some other issues, which if not addressed can result in a serious fire and safety hazard.

Firstly, the capacitor MUST be X or Y rated, at the appropriate mains voltage. These are not just 250V AC components, they are specially tested and certified for continuous operation between line and neutral or earth. Remember, if the capacitor shorts out, the consequences can be dangerous. Secondly, the surge-limiting resistor, as you pointed out, needs to be a 1W device. Equally importantly, it should be rated at 250V AC.

Thirdly, there should be a high-value, 250V AC rated resistor across the capacitor, typically 1M or so, to discharge the capacitor when power is removed. Otherwise the capacitor can remain charged, causing a hazard for anyone servicing the equipment.

THIS MONTH'S WINNER!

Fourthly, you must consider the transient surge which occurs when the capacitor is fully discharged and the power switch is closed at the peak of the mains cycle. At this point, the capacitor is essentially a short-circuit, until it charges. If you feed the capacitor output to a full-wave bridge, the best place to absorb this transient is at the bridge output. However, this implies the bridge should have a much higher voltage rating than you'd think. I suggest a 1000V rating because of the very high transient voltages the bridge will see at switch-on.

At the bridge output, the transient can be absorbed with a normal filter capacitor of a few hundred microfarads, in parallel with a low-inductance monolithic 0.1uF capacitor. It's therefore crucial that the bridge is always connected to its load. Otherwise, the filter capacitor voltage will climb to the mains voltage, with obvious consequences. The simplest way to prevent this is to fit a 1W zener of the appropriate voltage. In many cases this is all the voltage regulation you'll need.

Finally, I recommend fitting a surge suppression device, such as a MOV, across line and neutral at the input to the circuit. Mains transients can be up to a kilovolt or more. If these precautions are taken, and the equipment is mounted in a double-insulated enclosure, then this method of voltage stepdown is perfectly safe.

If you want to draw more than 10-20mA, there are other non-transformer solutions. In particular, Harris Semiconductor makes an 8-pin device which uses a storage capacitor and a power FET to downconvert 240V AC to 5-40V DC. It costs around $8 and can supply 50mA, or more with an external FET.

I also strongly urge the use of an isolating transformer while testing such a circuit. This device lets you safely probe the circuit with an oscilloscope, without the risk of electric shock. Remember that the biggest risk occurs when you inadvertently connect the scope probe's earth clip to a live rail. Most scopes are not earthed, so at this point the whole scope case is live. You probably won't survive if you inadvertently touch the case!

Perhaps it would be a good time for an article in EA about safety, in particular about the hazards involved in servicing microwave ovens, where the magnetron anode supply of around 4kV at several hundred milliamperes is much more dangerous than 240V AC. (Andrew Mayo, email)

Thank you Andrew, for filling in some of the points I didn't make in December. Yes, you should most definitely use suitably rated components, including the voltage ratings for any resistors. It's often difficult to find out the voltage rating of a resistor, but as far as I know, a typical 1k, 1W (or higher) wire wound resistor has a 250V rating. As well, I totally agree on the voltage rating of the bridge rectifier, as transients pass through a capacitor as if it was a short-circuit.

The next letter makes similar points, but is not so supportive of using a capacitor in this way:

My advice on this subject is to forget it. Either use a resistor or a transformer. Using a capacitor seems attractive at first glance, but in practice the technique is fraught with difficulty. The biggest problem is high voltage spikes, which can put a massive strain on the surge-limiter resistor, which will often go open-circuit for no apparent reason, even though it may run cold in normal operation. The same applies to the rectifiers following the capacitor.

A similar problem occurs if the mains is switched on at the peak of a cycle — 340V is instantaneously applied to the capacitor, producing a massive current surge. An even worse situation can arise if there's a dodgy mains connection; imagine if the power is interrupted at the peak of a negative half-cycle (leaving the capacitor charged to minus 300V or so), and is then restored at the peak of a positive half-cycle. Wham!

I remember an article on this subject many years ago in the British magazine 'Television'. It seems that most UK TV set manufacturers have tried this technique at one time or another, as a 'lossless' means of dropping the 240V mains to the 150V or so required by series-connected valve heaters.

None of them persisted with it for more than one model! (Keith Walters, Schofields, NSW)

As far as I know Keith, this technique is not generally used with circuits that take more than a few milliamps, as the value of the series capacitor becomes quite large, making it too expensive. But it is used a lot in security lights and other low power circuits, so I wouldn't dismiss the idea as being unreliable. But certainly, as already explained, you must use suitably rated components, and take the greatest possible care.

Please don't interpret the above as being a recommendation to use this technique to power a low voltage circuit. There are many very real hazards that can cause injury or even death, and and unless you get it right, the circuit probably won't work reliably anyway.

Top floor lamp failures

In December, reader T. Hookway asked why the top floor light in the stairwell of a multi-storey building was typically the most unreliable. I suggested the mains voltage might be higher at this point, but as I really had no other suggestions, I also asked readers to comment. Here's the first letter:

I found the story about light bulb failures on the top floor of a building quite interesting, as I have had the same problem — in two different houses. In my own house (built in 1978 with the same gauge wiring as modern homes) I had regular lamp failures every few months, in two different but adjoining rooms. The intriguing thing was that both light fittings were mounted on the same rafter, which led me to believe vibration might have been the cause. I solved the problem by replacing them with fluorescent fittings. Most of the other bulbs in the house have been there for 20 years, with any lamp failures being typical.

About four years ago, my mother moved into a new house, and the mystery bulb failures started again. Again the lamp fittings were mounted on the same beam and again they were in adjoining rooms. The problem however was much worse than in my home, with bulbs failing every few weeks. I tried various brands of light bulbs, from low cost to expensive, but it made no difference. Again I solved the problem by fitting fluorescent lamps. I hope this sheds some light (!) on the subject. (Kendrick Reed, Pialba, Qld)

Thank you for describing your experiences, Kendrick. Given that you solved the problem with fluorescents, perhaps vibration was the cause, although it's hard to imagine one rafter vibrating in a ceiling. However, this might not solve the original problem, as our correspondent has tried compact fluorescents, which I'd assume would not be prone to failure through vibration. So what does the next letter suggest?

I must say that in all the multi-storey buildings I have worked in, I have not found it a common thing for top storey stairwell lamps to regularly fail. If it were true, building management would ensure that something was done to correct the problem. In my experience with this sort of problem, the cause is usually a faulty bayonet or screw socket. In blocks of flats it is not unusual for stairwell lamps to be exposed to some degree of moisture ingress, as in domestic bathrooms.

It may be that the springs in the bayonet fitting have lost tension, or the contacts have become oxidised, giving a poor contact. Either problem can cause a high resistance connection at the lamp, and heat to be generated in the lamp fitting. Eventually arcing will occur, thus causing the lamp to rapidly switch on and off, leading to premature lamp failure. I suggest Mr Hookway checks the lamp socket. (Ross Herbert, email)

Thank you Ross, for this suggestion. Certainly a poor connection to the lamp can lead to its early demise, as I found out a few years ago with a faulty Edison screw lamp fitting. But while the above suggestions make technical sense, *EA* staff member Graham Cattley has another idea.

He has lived in various blocks of units, and points out that the top-floor stairwell lamp is often stolen (and replaced with a faulty lamp) by unit dwellers, when they need to urgently replace a lamp in their own unit. Lamps from other floors are not suitable, as the people traffic means the offender might be caught. I wonder...

What??

This month's question involves prototyping board, often called strip board or Veroboard. It comes from Richard Graham (Nelson, NZ), who asks:

The irregular shaped piece of strip board shown in Fig.4 has 64 squares. The question is, how do you cut this board into two parts so that, without turning either part over, they can be arranged as an eight by eight square? The cut must be continual, but does not have to follow a single straight line. The cut must also be along the copper tracks of the prototyping board.

Win this great Contrib of the Month Prize!

As an added incentive for readers to contribute to this column, we're now offering a valuable prize to the question judged most interesting, or the answer/response judged most informative, each month. The prize is a Mod-Col 38/54 high-res PAL colour video camera module from sponsor Allthings Sales & Services, with 450 lines of resolution, built-in digital signal processing, electronic shutter and auto gain control — valued at over $400!

Fig.5: Solution to February's What question.

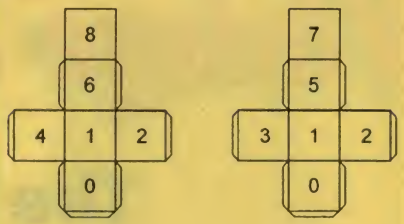
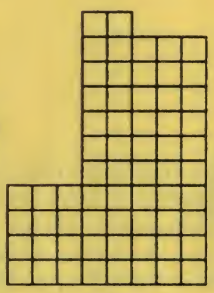


Fig.4: How do you cut this piece of stripboard into two pieces that can be arranged to form an 8 x 8 square?



Answer to February's What

The trick with this question is to recognise that the numeral 6, when turned upside down, becomes the numeral 9. As well, the numerals 0, 1 and 2 must appear on both cubes. A possibility is shown in Fig.5. My thanks to Robert Mitchell (Newtown, NSW) for the answer. ❖

Vintage Radio

The Tasma 'Roller-blind' sets

Thom and Smith's 'Tasma' brand of radio was a major seller in Australia, from its humble beginnings in 1929 to a severe crisis in 1952/3. Amongst their more collectable examples are three models produced just after the Second World War, curiously referred to as the 'roller blinds'...

ALTHOUGH THE brand is virtually unknown today, it had a long and distinguished lifetime. Indeed, glancing through the indices of the later *Australian Official Radio Service Manuals* shows that 'Tasma' radios only ceased in their own right in 1953, thereafter being known as 'President-Tasma'.

During the War years, Australian firm Thom and Smith produced radar and transmitting equipment and forewent production of domestic receivers. In this they were not alone, for radio manufacturers of practically any description were obliged towards wartime production of military equipment.

After the war, the domestic market was hungry for radios, and with the injection moulding techniques now at their disposal, many a fancy bakelite radio was being produced which was quite distinguished and characteristic to a given brand. Healing, STC, Stromberg Carlson, Kriesler and Radio Corporation (Astor, Peter Pan and Monarch brands) are amongst the classics, and coloured examples are very keenly sought after by collectors — with consequently healthy price tags to match!

Fig.1 (right): The medium wave four-valve 1101. Tuning is via the long white roller along the bottom edge of the dial.

Fig.2 (below): The dual wave M1206 used the same chassis and cabinet, but there the similarity stopped.

Tasma opted for a most unusual design of a mantel receiver, which has colloquially become known as the 'roller blind'; an example is illustrated in Fig.1. The name came about because the tuning control is the long grooved rod which spans the lower edge of the dial, and located between the dial and the speaker. Fig.2 shows another example of the dual wave version (white knobs) removed from its cabinet together with a broken dial cord, giving a better idea of the construction.

The model 1101

This first version was released in 1947, and continued in production for three years until 1949. This is assumed because the *AORSM* indices for 1948 and 1949 refer back to the 1947 manual for the model 1101.

The radio circuit itself contains no real surprises. (Fig.3 shows the circuit for the

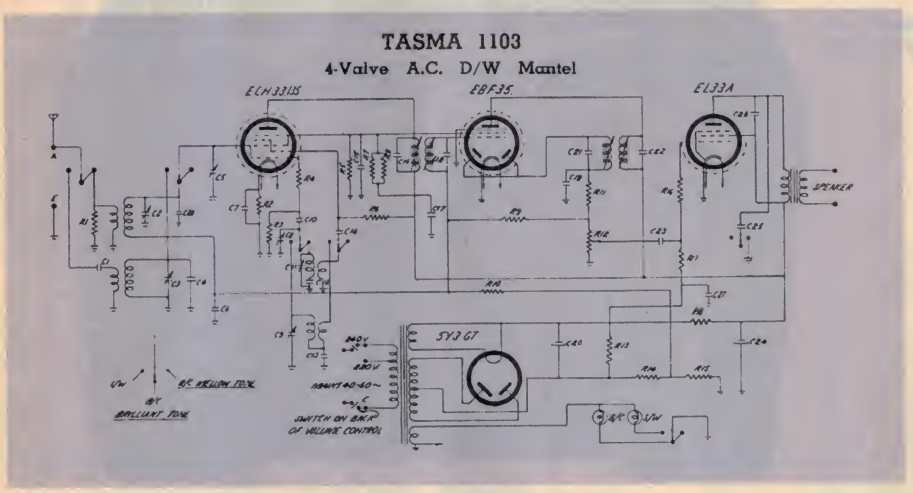


Fig.3: Not the circuit for the 1101, but that for the very similar 1103 dual wave model. The 1101 used an EK32 converter instead of the ECH33/35, and tuned the broadcast band only.

1103, but the 1101 was very similar apart from using an EK32 converter instead of the ECH33/35, and lacking the short wave band.) The engineers have made use of arguably the best valve lineup for the day, which together with high gain intermediate transformers and an efficient aerial coil, gave adequate sensitivity and selectivity for a mantel radio.

Not only was the public hungry for consoles, they were equally eager for the kitchen mantel to lighten the burden of mum's housework while she was blissfully rolling out the pastry and ecstatically ironing her loving husband's shirts. (That is, if contemporary advertising material is to be believed!) But back to the radio...

Circuit details

The EK32, an octode, was considered a good converter, and although it has the same conversion conductance as the reliable 6A8-G, it consumed only 4.3mA as opposed to the over-10mA of the 6A8-G. The EBF35 intermediate frequency amplifier has a gm of 1800umhos (i.e., 1.8mA/V) and a total consumption of merely 6.6mA compared with a gm of 1200 of a type 6G8-G 'flat strap' (and consuming 11.7mA into the bargain). The output type EL33(A) again has a bit more poke than its rival, the ever popular 6V6-G(T), having over twice the gm and drawing 7mA less current.

Despite the general acceptance of permanent magnet (PM) speakers during the post-war period, the Tasma 1101 opted for the energy sapping electromagnetic speaker with a 1500Ω field coil and a 5Y3-GT rectifier. Later models did have factory modifications, but I've been able to find no literature to support this so far. If any reader does have a 1101 with a PM speaker, look for the obvious signs of replacements. They will show themselves somehow, somewhere. Otherwise, we can assume a factory modification. Indeed, the model used for the purposes of illustration (Fig.1) has a 5" PM speaker with a heavy duty 1500Ω filter resistor mounted on insulators above the chassis, and is clearly factory made.

The circuit is a straight superhet in which the output valve is fed directly from the detector/IF amplifier, and the 0.5M pot serves as both diode load and volume control. Back bias is used to all stages, and simple AGC is incorporated for the converter and IF amp. A three position switch for variable top-cut treble tone control completes the circuit. Otherwise, the circuit is about as conventional as can be.

Construction

However there is nothing conventional about the construction. In looking at some of the radios of the immediate pre-war and post-war era, one can only wonder what possessed the designers. The array of metalwork and brackets, spacers, springs, wheels, drives and shafts seemed unduly complex, just for the sake of giving a particular set a differently shaped dial or some other distinguishing feature. But, it must be said, it is these characteristics which gives a given set its individuality and makes them collectable. The Tasma 1101 is no exception.

The layout is not particularly conventional. Looking at the chassis from the back, the mixer is at the back of the chassis, and to its left is the first IF transformer in the corner. The IF amp is midway along the left hand edge, with the second IFT in the front left corner of the chassis. The output valve is in the far right corner of the chassis.

Alongside the second IFT along the front of the chassis is a spare hole for an audio amplifier. The rectifier is stuck away under the dial(!). Shielding for the wiring between the detector and the output valve is not via conventional shielded wire, but rather normal wire being passed through a metal tube.

The fixed components and valve sockets are reasonably accessible, so servicing, apart from restringing the dial, does not pose too much of a problem. The tuning capacitor is in the middle of the back of the chassis with the vanes opening inwards, and the moving vanes are secluded by the roof-top dial!

The M1206

The M1206 is built on the same chassis and enclosed in the same cabinet, but there the similarity ends. This model is a five-valve dual waver, and was produced in 1950. It is a mongrel of a thing. The valve line-up is a 6AN7 converter, a 6N8 duo-diode variable mu pentode IF amp in which the diodes are not used, a 6BD7 duo-diode triode det/AGC/audio followed by a 6M5 output. Back bias is applied to the IF and audio amp, and ultimately to the mixer which also has cathode bias.

Fig.4: The large table model 1195, with its more than adequate 'roller blind' tuning control!

Perhaps the mixer is slightly overbiased to prevent overloading. Simple AGC is applied, despite there being plenty of diodes to choose from!

The tone control is incorporated into the enormous wave-change switch, which effectively obscures all access to the valve sockets. The wave-change switch is a three position affair in which the positions are medium wave, medium wave 'mellow', and short waves. This was achieved by using the sixth pole of the switch to act as a crude tone control, connecting in a 0.05uF capacitor to earth from a 50kΩ tapping on the anode load of the 6BD7.

A degree of negative feedback is provided by the unbypassed cathode of the 6M5, and a 0.05uF capacitor connected from the 6M5 anode to a further 50kΩ tapping on the 6BD7 anode load provides a degree of bass boost. A further degree of feedback is via a 50pF capacitor from the 6M5 cathode to grid.

M1206 construction

The M1206's use of the same cabinet, chassis and dial mechanism is where its similarity to the 1102 starts and finishes. Underneath, it is not a good example of design layout. The valve location is per the 1101, but the additional hole in the front of the chassis is now occupied by the 6BD7. The rather long shaft of the switch extends to switch banks at the rear of the chassis. Crammed in amongst all this lot are three of the four coils. The broadcast band aerial coil is mounted above the chassis, beneath the 'roof' of the dial plate.

To complicate things even more, not only do switch banks and coils almost obstruct the valve sockets, but so too do fixed components — some of which have had their leads shortened to the barest minimum length so that it is not convenient to nudge them to one side. That is, assuming there was some available space to do so!

The valve sockets themselves are the cheap and nasty punched variety. A few grams too much pressure whilst trying to remove a component or wire, and the lug and associated pin socket breaks free from the paper thin housing material. The result means replacing the socket, which is by no means easy since the sockets in question have the large flange designed for the 1-1/8" holes originally intended for octal sockets. Better valve sockets were available at the time...

Servicing

The problems of the 1101 aren't at all too bad. The only real problem is that the wire passing through the metal insulating tube from one side of the chassis to the other can lose its insulation. Assuming the paper capacitors and electrolytic capacitors need replacing, there are few other problems assuming that all coils and transformers are intact. Alignment is standard procedure.

The M1206 is a colour of an entirely different hue. Here, the access to the valve sockets of the 6AN7, 6N8 and 6BD7 is difficult in the extreme. Trying to measure voltages at the valve socket becomes a real juggling act and one must ensure that the test prods don't short to some other component or wire in the process.

As with the 1101, the screens of the converter and the IF amp are fed in common from a voltage dividing network with two paralleled resistors at the top, and another to earth. All of these resistors are 50kΩ, one watt.

Removing the speaker to replace a burnt-out audio transformer can also be a chore. The transformers as supplied were the smallest available. If one is not to hand, the proprietary line M-1100 (Dick Smith Electronics) will bolt directly in place, but its larger physical dimension means that the speaker must be carefully 'prised' back into position, and ensuring that the lugs do not short against the dial backing plate. Although these transformers are supposedly 'line' transformers, they do work quite well.

A shared difficulty on both receivers will be re-stringing the dial. They are the same in each case, and as the 'roller' is rolled toward you, the dial pointer travels from the back of the dial to the front, and of course vice-versa. Bearing that in mind, it will be left to the owner to puzzle out the route and course of the dial string. Once again, access to the tension spring on the capacitor drum is not easy, so keep as much tension on the dial cord as possible during the entire stringing process.

Performance

The 1101 does its job quite well, for what it was designed to do. It picks up all the locals at adequate volume and sensitivity, and gets the stronger interstate stations during the evening hours with about 10 feet of antenna.

The M1206 beefs far too much audio into a 4.5" speaker, and overloads it on the broadcast band. The shortwave performance is quite good, with quite efficient coils space wound with silvered wire on low-loss formers and with the 6AN7 converter, works quite well. However, delayed AGC would be an advantage.

The 1101 is clearly a mantel set, whereas the M1206 is another example of a high gain design which would have been much better suited to a 10" speaker in a console cabinet.

The 1195

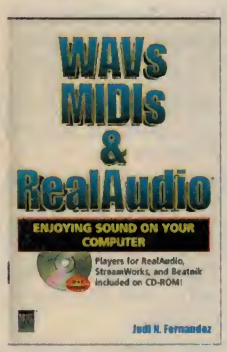
Finally, a brief mention of a vibrator powered table model, the 1195. This was quite a robust model, with a roller blind to end all roller blinds! The tuning control is the silver bar at the front edge of the cabinet, and the dial itself is of 'quarter-round' construction with the pointer travelling from left to right.

The radio itself is a four-valve dual wave set using an EK2-G converter running from 6.0V DC, and three 2.0V battery types 1M5-G, 1K7-G and 1L5-G. It is illustrated in Fig.4, and vibrator radios will be the subject of future articles. ❖

New Books

Digital sound files

WAVs, MIDIs & REAL AUDIO, by Judi N. Fernandez, published by IDG Books Worldwide (MIS Press imprint), 1998. Soft covers, 217 x 142mm, 328 pages. ISBN 0-7645-7507-4. RRP $54.95.



There's now quite a bewildering array of file formats used for digital audio alone, on PCs and for transfer via the Internet/Web — everything from linear uncompressed PCM formats such as RIFF, AIFF and WAV files, through to compressed formats like the MP3 (MPEG 1 Layer 3) files currently causing so much controversy. Plus, of course, formats that aren't sampled audio at all, but essentially music encoded for replay on a synthesiser or other electronically controlled instrument — like MIDI files. It can be quite a challenge to understand the various formats, let alone provide yourself with the software applications and/or drivers or plugins, to let you play and/or produce them.

This new book from the popular and prolific US computer writer Judi Fernandez provides an easy to read introduction to this topical and important subject, and also a handy practical reference. It not only covers each of the main file formats in current use, but also discusses suitable software to take advantage of it. As an added bonus it also comes with a CD-ROM giving a collection of handy shareware for both Windows and Apple Mac machines — and the text discusses the use of each program, to get you going.

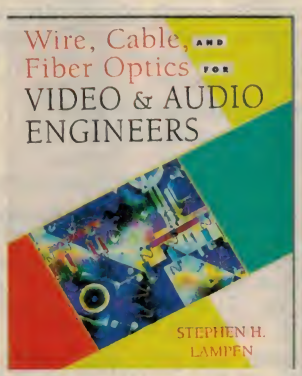
The Windows shareware provided includes Beatnik 1.3.2, Cool Edit 96, Crescendo 3.0, Jet-Audio 3.12, RealPlayer 5.0 and StreamWorks Player 3.1, while for the Mac user there's again Beatnik 1.3.2 and RealPlayer 5.0, plus Crescendo 2.0, QuickTime 3 and StreamWorks Player 2.04. There are also various system sound management utilities, for both platforms.

Overall the book seems well written and easy to understand, with a lot of useful information. So if you want to know more about sound and music files, and how to get the best from them, it's well worth considering.

The review copy came from distributor Woodslane, of 7/5 Vuko Place, Warriewood NSW 2102. (J.R.)

Interconnecting cables

WIRE, CABLE & FIBRE OPTICS FOR VIDEO & AUDIO ENGINEERS, by Stephen H. Lampen. Published by McGraw-Hill, 1997. Soft cover, 189 x 234mm, 285 pages. ISBN 0-07-038134-8. RRP $73.99.



This book deals with a very important and often forgotten aspect of electronics: interconnecting cables. Because it covers audio and video, almost all types of cables are discussed, along with the many measurement parameters that determine the type of cable best suited to a particular task. Unlike many other books on this subject, the treatment is relatively non-mathematical and is written in a very approachable way.

It starts with the basics, making few assumptions about the reader's expertise in cabling. Cable construction, noise rejection, impedance, flexibility, fire rating, wavelength and other important concepts are dealt with in the first few chapters, supported with many illustrations. A whole chapter is devoted to audio cabling, and includes digital audio, speaker wiring, patch panels, microphone cables and background theory.

Video cabling also occupies a chapter and covers cabling for analog and digital video, as well as patch panels, 75Ω connectors and typical problems caused by poor cabling. Cabling for multimedia (which the author attempts to define) has its own chapter, and includes explanations of terms like SCSI, data rate and asynchronous transfer mode, along with testing and installation practices.

As you'd expect in a modern book on cabling, fibre optic cables are described in good detail, including termination methods and the various types of fibre optic cable currently available. The important topic of connectors is given its own chapter, with many practical hints on how best to fit a connector to a particular cable.

Other topics include grounding (and eliminating ground loops) and cable installation methods, both of which highlight the author's practical experience.

There's a wealth of useful information in this book, presented in an easy-to-read style by a very competent author. The review copy came from McGraw-Hill, PO Box 239, Roseville 2069. (P.P.) ❖

Notes & Errata

Miniosc Audio Oscillator (December 1996): In the schematic the pin numbering of U1d is shown reversed — the inverting input should be pin 13, and the non-inverting input should be 12. Also, the input polarity of A4 is reversed in the block diagram (Fig.1). It should match the schematic with the feedback resistor going to the negative input. Our thanks to reader John Snell for alerting us to these errors. ❖

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See page 83 for more details.

Forum

(Continued from page 32)

these treatments, only surgery can claim 100% success, but then only in a miniscule number of cases, where a real physical deformity can be corrected.

When I looked up the subject on the Internet, I came across a Forum wherein sufferers related their experiences with different treatments and this is where the supporters of electro-therapy seemed to make the loudest noise.

Electro-therapy seems to consist mostly of electrical stimulation of the nerve, where is exits the skull via a tiny hole just above the ear. If this treatment was truly effective, I am sure that the medical profession would have adopted it by now. Bell's Palsy is not a dangerous complaint, but it is one that so seriously inconveniences the sufferer that any effective treatment would have been snapped up years ago. (The affliction was first described by Charles Bell in Scotland in 1860.)

If any of the proponents of electro-therapy reading this article can guarantee me relief from my symptoms, I will be only too glad to support them in their crusade — after I have been cured.

So there you are. I'm sure you'll support my messages of sympathy to Jim Lawler, and I hope he turns out to make a rapid and complete recovery. In the meantime, it'll be interesting to see if any of the proponents of subtle energy medicine take up his challenge, won't it?

See you here again next month, I hope. ❖

Electronics Australia **is one of the longest-running technical magazines in the world. We started as *Wireless Weekly* in August 1922 and became *Radio and Hobbies in Australia* in April 1939. The title was changed to *Radio, Television and Hobbies* in February 1955 and finally, to *Electronics Australia* in April 1965. Here are some interesting items from past issues:**

50 years ago

March 1949

Radar Opens Up Fog-bound Harbours: A new surface search radar, specifically designed for use on merchant ships, is now being produced by General Electric. It will assist navigation in restricted waters.

Known as the MN-2A and designed to complement the MN-1-B, or S-band radar, this set operates on the X-band (9375Mc/s) and provides ranges between 70 yards and 30 miles, and resolution on a 70-yard range of a one-degree bearing.

Principal advantage of the MN-2A, operating on a 3cm wavelength, is the high resolution — which gives clearer pictures in narrow waters. Indication and data output is recorded on a seven-inch Plan Position Indicator (PPI) scope.

Television manufacture: On his return from England, Mr Ray Allsop, who is attached to the EMI organisation in England, said that his company was prepared to make television sets available in Australia for £50, and larger types for £100.

We would have felt a little happier if his news had been that the Australian radio factories were able to market receivers for this figure, and if possible a good deal less...

25 years ago

March 1974

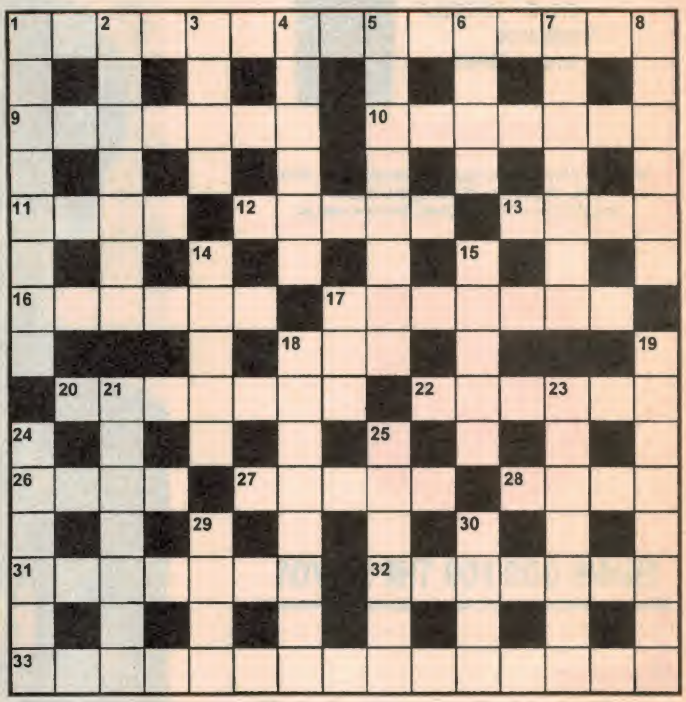
Domestic Satellite System for USA: The explosive growth of communications traffic in the United States is beginning to outstrip the facilities offered by conventional communications systems. A domestic communications satellite system, scheduled to become operational in September 1975, is currently being implemented by GTE Satellite Corporation to meet future short-term needs. It will be capable of handling all types of commercial traffic, including telephone calls, telegraph, facsimile, high-speed data, and both colour and black and white TV.

The system will include earth stations in California, Florida, Hawaii, Indiana and Pennsylvania, which will be interconnected by a satellite 22,300 miles over the equator. Total gross investment for the system is estimated at more than US$52 million.

Renewed Interest in Cable TV: The recent resurgence of interest in cable television in Australia is seen as good news for the Australian electronics industry, which is currently preparing for the advent of colour television following the recently announced tariff reductions.

Amalgamated Wireless (Australasia) Limited already has a subsidiary cable company, AWA Rediffusion Pty Ltd, which has been operating in Australia since 1971. ❖

Crossword



Across

1 Said of computers with ICs. (5,10)
9 Temperature scale. (7)
10 Brand of hifi equipment. (7)
11 A little Greek letter. (4)
12 Lodes. (5)
13 Space agency. (4)
16 Again shows a movie. (2-4)
17 Device for translating signals. (7)
18 Unit of pressure. (3)
20 Kind of energy. (7)
22 Space program. (6)
26 Commercial showing; fair, display. (4)
27 Observed fact. (5)
28 Battery fluid. (4)
31 Pulling device. (7)
32 Systematic study. (7)
33 These too use heat-sensitive paper. (7,8)

Down

1 Said of a third winding. (8)
2 Starter electrode. (7)
3 Acronym for dielectric-insulated IC. (4)
4 First in a decade. (6)
5 Increases the dynamic range of signals. (8)
6 Familiar small constituent of an element. (4)
7 Process repeatedly. (7)
8 Perpendicular line. (6)
14 Successful processor chip manufacturer. (5)
15 Closed circuits. (5)
17 Digital-to-analog converter. (3)
18 Nature of a standard stethoscope. (8)
19 Type of electric jug. (8)
21 Said of concordant waves. (2, 5)
23 Authority to operate. (7)
24 Group of six. (6)
25 Extragalactic source of radiation. (6)
29 Piece of news. (4)
30 A type of meson. (4) ❖

February's solution:

	D	O	U	B	L	E	A	D	A	P	T	O	R	
C	V		L		N		I		Y		X		C	
A	N	E	R	O	I	D		C	A	R	R	I	E	R
T		R		W		U		T		O		D		I
H	O	W	L		A	S	S	A	Y		B	E	A	M
O		R		S		E		T		P				P
D	R	I	F	T	S		B	E	T	A	R	A	Y	
E		T		R		C	E	S		N		N		A
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C	O	N	D	U	C	T		M	A	C	H	I	N	E
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Electronics Australia's

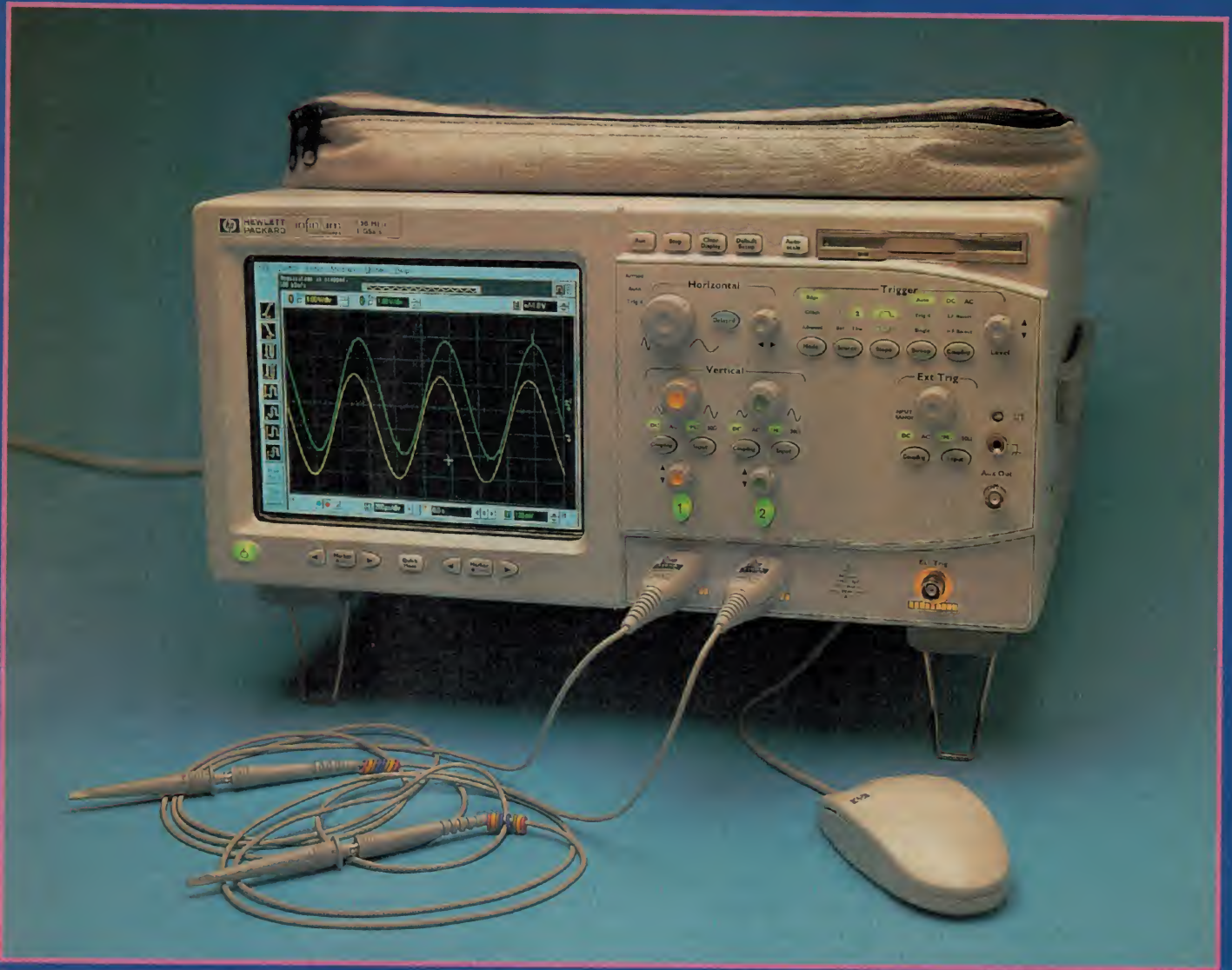
Professional Electronics

Australian firm enhances satellite news gathering

Philips unveils technology for home DVD recording

Silicon Valley CEO quits, to track down alien spaceship!

Reviews of
Fix-It 2000 Millenium Card,
Electronics Workbench Layout



HP's 54810A Infinium scope: inbuilt PC + Windows 95 GUI gives ease of use unprecedented in a high-end instrument!

News highlights

Aust firm enhances satellite news gathering

AUSTRALIAN ADVERTISING and communications firm Pilgrim International has launched a global communications system claimed to represent an important development in fast turn-around satellite delivery of news gathering information. Importantly it allows individuals from any location in the world to send broadcast-quality video coverage of important events to the global stage, independent of the major TV networks.

Pilgrim Chairman Greg Low comments "The portability and compact nature of our system design makes it easy to transport anywhere in the world, even by light aircraft and at short notice to remote areas. Pilgrim's unit can provide direct communications services in areas not serviced by mainstream electronic broadcast systems."

The Pilgrim system works in the field with video and sound footage of an event being edited on site, using a Sony SX laptop field editor. The cut story is then stored as an MPEG2 or MPEG1 file and transmitted electronically via INMARSAT-B satellite phone to Pilgrim, where it is then received on a specially designed computer which converts these files back to video and audio format for conventional TV networks. From Pilgrim the data is transmitted to receiving stations around the globe. Pilgrim has an earth station network in place for Seattle USA, Canada, the UK and New Zealand.

Designed by Pilgrim International for World Vision, the new system was trialed in Bangladesh and more recently used by World Vision in Indonesia. Footage of the riots was edited on location and beamed back to Sydney. The finished stories were then sent to several other destinations around the globe, and were instrumental in World Vision's global fund raising for the Indonesian 'Food for Work' campaign.

The Pilgrim communications system weighs some 83kg and packs compactly into several strong metal boxes. It comprises a betacam video camera, edit suite, modern satellite phone, and computer workstation with collapsible keyboard and satellite disc. The computer workstation was specially designed by Pilgrim for World Vision.

Lucent buying Ascend

US-BASED GLOBAL telecomms equipment maker Lucent Technologies is buying computer networking specialist Ascend Communications, in a deal worth around US$20 billion.

The combined firm is expected to become the world's largest communications networking company, and a major player in integrated digital communications, as Ascend's strengths are believed to complement strategically any gaps in Lucent's own capabilities.

Richard McGinn, chairman and CEO of Lucent Technologies, addressing the Churchill Club in Santa Clara, California on the day that Lucent's acquisition of Ascend Communications was announced. (Business Wire photo.)

Philips announces DVD recording technology

PHILIPS ELECTRONICS says it has developed technology for real-time recording of DVD-Video discs by consumers. The recorded discs can be played back on existing DVD-Video players. The system offers up to four hours of record/playback time at DVD to VHS quality levels.

The breakthrough was achieved by using DVD+RW technology with 4.7GB capacity. The technology offers the performance required for real-time recording of off-air television, camcorder tapes and other non-copyrighted video sources. DVD-Video quality level, including variable bit-rate recording for optimal quality, can be reached by using 'lossless linking', a technology developed specifically for the DVD+RW 4.7GB format.

Adri Baan, Chairman and CEO of Philips Consumer Electronics division, stated that the technology offers two unique advantages. "The recorded discs can be played back on existing DVD-Video players and recordings can be made in real-time. There is no need for a lengthy, multi-step process on a PC."

Mr Baan added that "DVD-Video will become the mainstream video distribution format. The Philips DVD-Video recorder technology is an answer to consumers' expectations: a DVD-Video player compatible recording format."

Philips plans to introduce the first DVD-Video recording products in the year 2000, offering very high picture quality and ease of use. The products will initially be aimed at the high-end segment of the video recorder market.

4.7 GB DVD-Video recording technology is based on the recently announced DVD+RW 4.7GB technology, which was designed for compatibility with existing DVD-Video and DVD-ROM equipment and for interchange between CE and PC platforms. DVD-Video recordings can also be played back on PCs with DVD-ROM drives and MPEG2 decoding capabilities.

NFSA radio CD set winners

IN OUR DECEMBER 1998 issue we offered two sets of *Australia's Radio Favourites* CDs from the National Film and Sound Archive in Canberra, to the readers who submitted the most interesting and/or amusing stories on the topic 'listening to the radio — then and now'.

The lucky winners were Mr Richard Percy, of Pambula Beach in NSW, and Mr Eric Warren, of Blackheath in NSW. Our congratulations to these readers for their success; each has already received their 10-disc sets of historic Australian radio recordings, and we trust they are enjoying them. We'd also like to thank the many other readers who took part in the contest, by submitting interesting stories. We'll try to publish the best of these in a future issue.

Swatches to be used as hands-free tickets

SCHLUMBERGER AND SWATCH are collaborating to add contactless electronic ticketing capability to watches, providing a highly convenient and fashionable means of using mass transit services. The first results have just been demonstrated in the Finnish city of Tampere, where travellers can now buy watches which operate in exactly the same way as the contactless Schlumberger Easypass ticketing card employed by the city's bus network.

This project alone has enormous possibilities for the transport industry, as the Swatch watch has been made compatible with IS014443A, the wireless protocol which accounts for some 90% of all the world's contactless electronic ticket applications. But ongoing work between the companies will extend capabilities of this novel approach much further, by allowing watches to be equipped with the transport-orientated Schlumberger FastOS smart card operating system.

FastOS provides a standard platform for contactless applications which is compatible with the complete range of specifications for transport smart cards including IS014443A, prENV1545 and IATA's specification for airline travel — the key standards in the mainstream payment card environment such as EMV and prENV1546, and the Schlumberger Easyflex smart card. With this kind of capability a Swatch watch could provide its owner with a stylish 'electronic passport' not only for travelling but also for purchasing goods and services.

In the application for the bus network operated by Tampere City Traffic Company — a partner in Finland's pioneering Matkahuolto integrated countrywide electronic ticketing network — an Easypass-compatible chip has been integrated inside the body of the Swatch watch and connected to an aerial located around the edge of the face. This performs identically to a Schlumberger Easypass card, allowing travellers to perform a secure ticketing transaction simply by passing the watch close to the ticketing terminal as they board a bus or enter the transport network.

"Electronic ticketing is revolutionising the way that mass transit networks operate" said Jonas Andersson, Schlumberger Marketing Manager Mass Transit. "This project builds on that success and demonstrates that smart card technology can be applied in highly innovative ways to speed and simplify commercial transactions."

1999 Engineering Yearbook

ENGINEERING DATA specialist IHS Australia has released its *Australian Engineering Yearbook 1999*, claimed as the most widely used buying guide for engineers.

The new 28th edition now includes more information than ever, covering over 4500 product categories in a wide range of engineering disciplines including mechanical, electrical, civil, construction, structural, process, mining and more.

Included in the updated and new information are details of more than 1500 suppliers, including representatives of overseas manufacturers; information on more than 20,000 local and overseas brand names; details of conferences and trade shows; contact details for Quality Certification bodies and relevant associations; and handy information on measurements, conversions and formulae. The Yearbook is also cross-indexed by product/services, company/brand name, and more.

IHS Australia is a division of IHS Group, a world-wide network of related information companies servicing customers in more than 95 countries around the globe. For more information on *The Engineering Yearbook 1999*, contact Therese Watterson, IHS Australia Yearbook Sales, on freecall 1800 062 299.

Hitachi Home Electronics has just released this new 61" HDTV set on the US market. It offers integrated satellite and terrestrial reception. (Business Wire photo.)

Qld firm supplies high-tech gear to Army

QUEENSLAND MILITARY electronics specialist Cypher Research Laboratories has completed a contract to supply equipment to the Australian Army's remote force surveillance units. These mobile forces operate across northern Australia in conditions ranging from desert to tropical rainforest.

The contract covered the supply of equipment from CRL's combat-proven secure tactical data system as well as on-site training and technical assistance to the units involved. The company's Research Director noted that CRL's continuing success in the combat data market stemmed from its ability to design and manufacture rugged, reliable, cost effective equipment with capabilities that reflected the mission requirements of its customers.

CRL has also signed a five-year maintenance agreement with the Australian Department of Defence, Materiel Management Agency - Army for multi-level maintenance support of CRL's CYCOM data terminals and ancilliary equipment. The contract is designed to easily accommodate in-service equipment, new equipment entering service and equipment that is moving from a warranty to the maintenance agreement. It calls for a normal response time of five days with 'emergency' repairs within hours.

1999 World Tube Directory published

US 'VALVE AUDIO' published Audio Amateur Inc. has announced the *1999 World Tube Directory*, the newest edition of its directory for DIY audio enthusiasts and professionals using vacuum tubes in audio. The 1999 edition features listings of vacuum tube manufacturers, wholesalers and distributors as well as a number of categories of tube-related equipment, supplies and services.

International in its scope, the *1999 World Tube Directory* features listings from 29 countries. A company address list, organized by country, allows the reader easy access to tube companies around the world.

Publisher Audio Amateur Inc. is a pioneering publisher of high-quality DIY audio books and magazines for 30 years. In addition to *Glass Audio* and *The World Tube Directory*, it also publishes *Audio Electronics*, *Speaker Builder*, *Voice Coil*, *The Loudspeaker Industry Sourcebook* and numerous books. The *1999 World Tube Directory* may be purchased directly by calling +1 603 924 9464 or by emailing to **custserv@audioXpress.com**. ❖

OPEN Fist

The Work at Adelaide Hospital...

by Stewart Fist

BACK IN EARLY 1993, there was a lot of discussion in the Australian press about the potential adverse health effects of GSM cellular phones. Eventually a research project was undertaken by a group of cancer scientists working through Adelaide Hospital.

Actually, there were two parallel research projects — one funded by the Electricity Supply Association of Australia (ESAA) to evaluate whether exposure to mains-power electric fields could cause or promote cancers (mainly leukemia), and another funded by Telstra to look at the possibility that GSM digital cellular phones could do the same.

The concern about power lines stemmed from a few epidemiological reports which suggested that people (mainly kids) living under power lines had a higher rate of leukemia than normal. There were parallel fears that cellphone handsets could do the same.

Leukemia is a disease of the immune system which involves the lymphatic nodes and white-blood cells, so the researchers decided to use a special breed of lymphoma-prone mice as sensitive (or rather, discriminatory) detectors of these effects. The studies were conducted over a period of 18 months, beginning late 1993 with 1400 mice.

The key to understanding and interpreting these experiments is to understand how meticulously the procedures are designed to avoid any possible extraneous influences.

The basic experimental protocol calls on the scientists to use two identical groups of mice, maintained in clean and identical environments. One group is exposed to the suspect toxic substance while the other is not exposed, and called the 'control'.

Many decades of experience have convinced the biomedical research industry that it must be extraordinarily careful to avoid extraneous influences. So a second requirement is that the research must be conducted 'blind'. No one able to influence the results should know which mice are exposed and which are not.

I don't think it's generally understood how meticulously planned these experiments really are, or how costly such research can be.

In the case of the radio frequency experiment, there were 100 mice in each group. They were held, five at a time in small plastic cages in two identical rooms which were shielded from external radio signals by a millimetre of aluminium sheeting.

Both rooms were equipped with vertical ground planes (2.5 x 2.2m) with a quarter-wave monopole at the centre, and the exposed group received two 30-minute doses of RF a day, with a computer in control of the time and duration. The radio signal was of the GSM-type — pulsed (217Hz) 900MHz signals with a pulse width of 0.6ms — calibrated so as to match normal human-head/handset-power densities.

What annoys me most about the reporting of these results is the way in which human consequences were so summarily dismissed in public. Meanwhile, around the world they were treated as immensely important within the scientific establishment.

Where the experimental design can be criticised is that it fails to place the antenna against the side of the mouse head. The mice had distributed absorption over the whole of the body, while human exposure is localised. Both the mouse body-size and orientation change the characteristics of RF absorption, but thermal resonance effects weren't detected.

It can also be said that the exposed mice were in the far field rather than the near field, and also that the mice were exposed to RF but not inductive effects, which in cellphones can be more significant in energy transfer than the antenna radiation.

But no experimental design is perfect.

The animal house staff were never told which group was exposed and which was the control. Sympathetic animal-loving staff might treat the mice differently if they knew, which is why the antenna systems were duplicated. In the scientific literature, this is referred to as 'sham' exposure of the control group.

Whenever animals died or developed tumours to the point of discomfort, they were killed and sent for autopsy. Dr Alan Harris, who performed the microscopic examination of the corpses at the Walter and Eliza Institute in Melbourne, only had identification numbers attached to the mice. This ensured that he too had no knowledge of whether the mouse had been exposed or not.

The first person in the research chain able to associate the incidence of tumours with either of the two groups, was the statistician Val Gebski at Sydney University. He began to notice a excessive rise in tumour rates among the exposed group from about nine months, and it continued to rise for the duration of the 18-month experiment.

Normally T-cell (Thymic) lymphomas are found among these mice. T-cells are the more mature disease-fighting cells, but here the exposed mice showed a doubling of B-cell (Basal cell) lymphoma rates also. This suggested that DNA in the immune system was being disrupted during early cell-growth stages.

Absolute numbers don't mean much here, because these were lymphoma-prone mice. The significance lies in the ratio between the control and the exposed group, and secondly in the type of lymphomas being created or promoted. This kind of research is also complicated to some degree by mice dying from causes not related to the exposure environment, although nothing of significance was detected in this case.

Eventually the rate of tumours among the exposed group was calculated to be 2.4-times that of the unexposed group, at the time the project ended.

However statistical adjustments are necessary to allow for the likelihood (or not) that any such a difference could have arisen by chance. This is always a possibility when dealing with human or animal genetic variability, no matter how well the research has been conducted.

For reasons too complex to go into here, the final determination was that RF exposure at

least doubled the lymphoma rate, and this was established to a very high degree of certainty (99.9%). This confidence figure is about 10 times more 'certain' than scientific results classified as 'significant' (99%) and 50 times that which is normally accepted as 'proven' (80%).

The researchers state modestly that their findings are "highly significant", and most of the genuine biomedical research industry appears to have accepted this evaluation. Of course, the scientists also issued the standard warning against extrapolating such findings to humans, and they also suggested that the results required independent replication to be 100% sure.

Of course, both remarks are true, but there's also an element of the 'bleedin' obvious' about these ritualistic observations. No research of this kind is ever considered in isolation by the scientific community, and it is well known that there are many other research findings with similar conclusions.

Nor can human associations be lightly dismissed. The findings were highly significant in terms DNA disruptions, and, as one of the scientists admitted to me, 'DNA is DNA'. Mice DNA and human DNA show almost identical characteristics, even though the outcomes of gene disruption might be different.

Summarily dismissed

What annoys me most about the reporting of these results is the way in which human consequences were so summarily dismissed in public. Meanwhile, around the world they were treated as immensely important within the scientific establishment.

You don't need to be a scientist to point out that this $1 million research program was not designed to ensure the health of mice. There were, surely, some human implications — yet any such suggestion was dismissed.

And, in reporting positive and negative results, the scientist needs to be consistent and even-handed. If a result doesn't apply to humans when it is positive, then it also doesn't apply when it is negative or inconsequential.

In the parallel ESAA study, far less convincing links were found between 50Hz exposure and lymphoma, to the point where the scientists were able to dismiss the findings as 'not proven'. This is probably the case since the experiment was inconclusive.

But the parties involved then actively sought out the television news crews, and gave interviews on camera and to the press announcing that these results should "quell fears that powerlines might cause childhood leukemia".

They did not add any qualifications that such supposedly favourable results (a) required replication, and (b) were single isolated findings, which (c) are only applicable to lymphoma-prone mice!

When the results of the RF study was released in May 1997 (an unconscionable two years after completion) the Cellular Telephone Industry Association (CTIA) jumped into print (mysteriously a day before the research results were released in Australia) with a statement dismissing the research because it used "genetically-engineered mice" rather than normal mice.

In the process, of course, they were effectively dismissing the viability of billions of dollars of global medical research each year. Specially bred mice are constantly used for just this purpose — to act as sensitive detectors for minute environmental changes. Detection of potential long-term effects must use animals with increased sensitivity, if they are to see results within the lifetime of a mouse.

And clearly, as every radio engineer knows, if you want to reduce background noise, then you select the most discriminating detection system available to you.

The CTIA also quoted Dr Basten as saying "Mice and humans absorb energy from these fields differently, so we cannot conclude from this single study that humans have an increased risk of cancer from the use of digital mobile phones."

In fact, humans in the near field absorb four to 10 times more energy than that experienced by the mice, because they have induction effects as well as antenna radiation. Up to 80% of the energy from a cellphone transfers to the human head by induction. ❖

FIX-IT 2000 Millennium Card

Can a single ISA card eliminate the millennium bug on your computer? Well, perhaps not completely, but we have recently looked at a Y2K fix that can at least bring your hardware into line...

by Jean-Baptiste Cattley

WITH ONLY NINE months to go before the millennium bug kicks in, you can consider yourself lucky if you haven't already been affected by the oversight of the century. Many millions have been spent on Y2K solutions, with many large companies completely replacing any suspect systems, rather than spend the huge amounts of time and money required to test them for susceptibility to the Y2K bug.

Most small systems owners don't have this option available, however, and will simply have to deal with any Y2K problems the hard way. One such problem is caused by the computer's system clock failing to roll over correctly, seeing the year '00' as an error, and reverting back to the start-of-epoch — usually 1980. Another problem occurs when the system only returns a two-digit year, thus confounding the efforts of even the most Y2K compliant software.

The FIX-IT 2000 Millennium Card from Microgram Computers is marketed as a drop-in hardware fix. It monitors the system time and ensures the correct roll-over from 11:59:59 on 31/12/1999, to 12:00:00 on 01/01/2000. It also returns a four-digit date to system date calls, as most Y2K problems stem from the fact that a noncompliant system will only return two digits for the year.

Leap year

Another subtle manifestation of the Y2K bug springs from the fact that 2000 will be a leap year, although many systems will not treat it as one. This peculiarity occurs because although years divisible by four are leap years, years divisible by 100 are not, *except when they are divisible by 400*. Very few systems take this last proviso into account, and will refuse to acknowledge the existence of the 29th of February, 2000. The Millennium card compensates for this, however, and will ensure that the date is reported correctly.

The card sits in an 8-bit ISA slot, and does not require a free IRQ. It can be configured for any one of four different I/O addresses, so it can be installed into virtually any system with a minimum of hassle. There is no software to install; the card operates at the hardware level, and doesn't require any kind of drivers or OS support.

As well, the Millennium card offers you the option to back up your system's CMOS settings and to store them in the battery-backed RAM on the card. Using the software built into the card's own BIOS (accessible by pressing F2 when the card's copyright message appears just after boot-up), you can 'grab' a copy of the motherboard's CMOS RAM, and keep it protected on the card. You can then restore the CMOS settings at a later date by simply selecting 'Restore' from the boot-up F2 menu.

Alternatively, you can configure the card to automatically overwrite any existing CMOS settings every time the computer starts, which would be of great benefit to machines where the user may accidentally (or maliciously) alter the system's CMOS settings.

Trying it out

Our test computer was a 1990 386 with a Phoenix BIOS, a machine that receives a lot of use, as it is currently acting as the *EA* BBS. Left to its own devices the machine fails the standard Y2K test and rolls over from 31/12/99 to 04/01/1980; a prime candidate for the Millennium Card, as we don't want to see all of our patrons bumped off the BBS because they haven't called back for -20 years...

The supplied six-page manual is quite lucid, and it turned out that all we had to do was to leave all the jumpers in the default positions and simply plug it into a spare ISA slot and turn the computer back on.

And — it worked! It worked well in fact, and the machine then passed all the tests we threw at it. So, it provides a simple and painless solution that should last us for the next 10 years or so. Why 10 years? Well, that's how long the battery in the card's RTC (Real Time Clock) module will last. After that, who knows? Maybe the Y2K bug will then come back to bite you in 2010, just when you've forgotten all about it... ❖

CI-5050 Millennium Card

Good points: Simple drop-in solution, doesn't require any software drivers. CMOS backup could be very useful to some users.
Bad points: None that I could find.
RRP: $129.
Available: MicroGram Computers, Unit 1, 14 Bon-Mace Close, Berkeley Vale NSW 2261. Phone: (02) 4389 9444; Fax (02) 4389 8388. Email: info@mrgsm.com.au; Website at http://www.mgrsm.com.au

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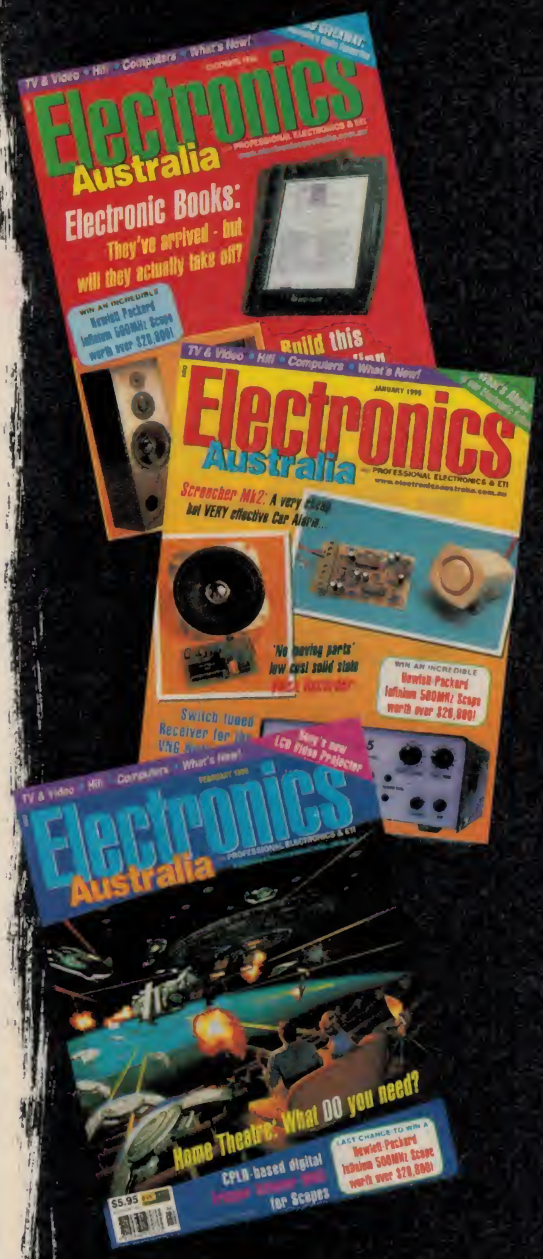

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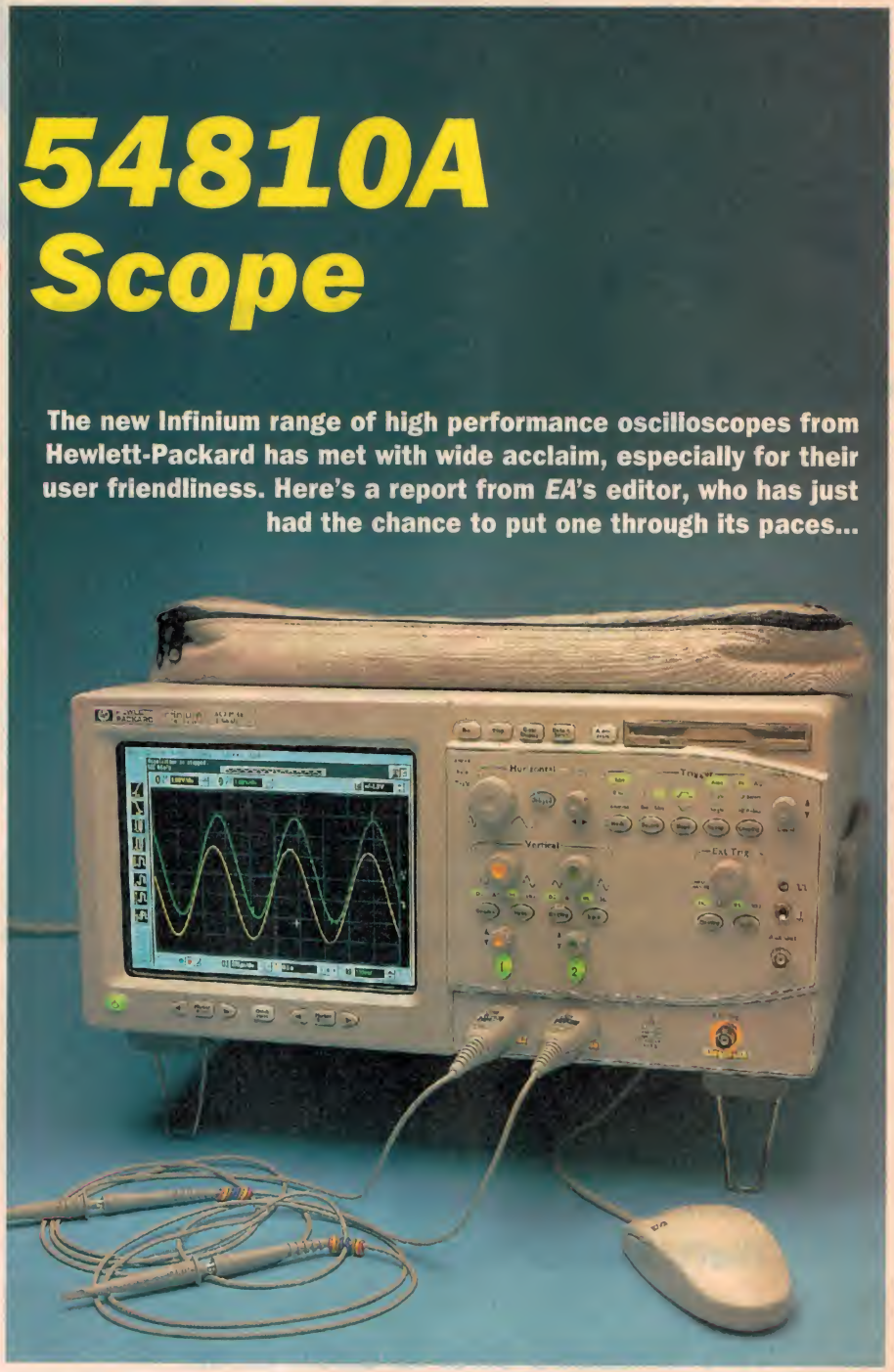
HP's 54810A Infinium Scope

The new Infinium range of high performance oscilloscopes from Hewlett-Packard has met with wide acclaim, especially for their user friendliness. Here's a report from *EA*'s editor, who has just had the chance to put one through its paces...

by Jim Rowe



AS MOST OF *Electronics Australia* readers would be aware, we've been offering one of Hewlett-Packard's new Infinium oscilloscopes as a subscriptions promotion prize, during the November 1998 — February 1999 period. Although the lucky winner of this instrument has yet to be chosen at the time of writing, I thought this would be a good opportunity to give everyone else a good idea of just how impressive these instruments are.

Back in mid-1997, I was lucky enough to try out a prototype Infinium scope very briefly during a visit to HP's plants in Colorado. It certainly whetted my appetite, especially after I was also able to meet HP's Infinium business team leader Dan Oldfield and some of the other HP engineers responsible for developing the new line. Since then I've been hoping for the opportunity to try one out again in a more leisurely way, and luckily that's just happened.

One of the things that impressed me about the development of the Infiniums was the way HP had spent US$1 million on a research study, to find out what engineers *really* wanted in a high-end scope. And the results were very interesting, because they showed that while engineers were generally happy with the level of measurement performance from modern instruments, they were very frustrated by their operating complexity and unfriendly user interfaces.

For example they really resented having to pore through enormous user manuals, just to remind themselves how to set up the instrument for rarely-performed measurements. They wanted an instrument that would be much more intuitive to use, and preferably one that wouldn't need a whopping great user manual.

As a result of the study, HP designers scrapped their existing designs for a new series of high-end scopes, and went back to their workstations — to come up with the Infinium range. And the effort was more than worthwhile, because the new instruments have won many awards (see *EA* October 1998 page 78, for example) for their excellent combination of performance and ease of use. They've also won HP some very big orders...

But what's so special about the new Infiniums? Well, HP's engineers knew that like most modern test instruments, today's high-end scope is essentially a dedicated microcomputer, with high performance data acquisition, display and user interface circuitry 'bolted onto the front'. They also knew that nowadays most test instruments end up being connected to the user's PC, in order to capture the measurement data for use in documentation and/or testing records.

So they decided the best way to go was to build a PC right into the scope itself, complete with a familiar GUI-driven operating system — Windows 95, as it happens. This brought some immediate benefits: for a start, the scope can now contain a full on-line context-aware user help system, available in exactly the same way as on the PCs that most engineers have on their desk. The equivalent of a user manual is only a mouse-click away, at any time...

Another advantage is that with a full Windows GUI, it became possible to make the scope's operation much more intuitive anyway. Instead of complex multiplexed-function softkeys and hard to remember menu trees, it was now possible to have 'point and click' operation with pulldown on-screen menus and icons, drag-and-drop measurement cursors, the ability to zoom in on waveform details simply by dragging a bounding frame around them, and so on.

This also allowed the scope's front panel to be simplified, and given back much more of the familiar 'analog' look and feel. In fact by giving the scopes a full-colour high resolution LCD display, they were also able to incorporate user-friendly features like controls with colours matching that of the traces they control.

Of course with a full Windows-driven PC inside, the Infiniums are also able to perform directly many of the functions that you'd otherwise need to do on a separate computer. For example you can print out a complete screen capture, on either a colour or monochrome printer, or save it on floppy disk; exchange measurement and/or setup data with other instruments, via an HPIB/IEEE-488 or RS-232C interface; pass test data to other computers via an Ethernet LAN; drive a separate VGA colour monitor or video projector, for presentations; and not surprisingly perform a huge range of maths, statistical processing and logging tasks directly on the measurement data.

Plus, of course, all of the functions and facilities we've come to expect from modern scopes — essentially analog convenience and ease of use, plus all of the waveform acquisition power of a digital instrument. So in short, the Infiniums are essentially like a high-end analog scope, a high-end digital scope and a powerful modern Windows-based PC, all rolled into one.

The HP 54810A

But what's an Infinium actually like, in practice? Well, having just had the chance to try out one properly, I'm now in a position to tell you.

The unit I've tried out is the HP 54810A, which is a two channel model with a maximum real-time sampling rate of 1GS/s (100GS/s in equivalent time) and a bandwidth of 500MHz. Like all of the other Infinium models it provides an active matrix colour LCD display, with VGA resolution (640 x 480 pixels) and an active display area of 159 x 104mm (8.4" diagonal).

Overall dimensions of the scope are 437mm wide by 210mm high by 440mm deep (including rear feet), with a nett weight of 10.6kg.

When you look at the rear of the scope, it's clear that there's a fairly standard PC inside. In fact the PC is based on an AMD K6 processor, running at 200MHz and with a 1.4GB hard disk plus 1.4MB floppy drive. It comes complete with a standard HP mouse, with a keyboard available as an optional extra.

I/O facilities fitted as standard, either on the inbuilt AMI motherboard or via standard PC-type cards, include two COM (RS-232C) ports, a PS/2 mouse port, a parallel printer port, an HPIB/IEEE 488.2 parallel port and an Ethernet LAN card supporting both UTP and coaxial (BNC) network cables, and all the usual networking protocols. There's also a standard compact 15-pin DB series socket which can be used to drive an external VGA monitor.

Needless to say there are other dedicated microcomputers inside the HP 54810A, apart from the PC itself. For example there's one managing the scope's front panel, and another running its acquisition system — plus others running things like the video display.

HP 54810A Infinium scope

A high performance two channel, 500MHz (1GS/s real time) digital oscilloscope with built-in Windows 95 PC.

Good points: Excellent user friendliness, due to the inbuilt Win 95 GUI and online help system. Good balance between mouse-driven GUI and familiar front-panel controls.

Bad points: Not significant...

RRP: $20,813

Available: Hewlett-Packard Australia. For more information ring HP's T&M Call Centre on 1800 629 485.

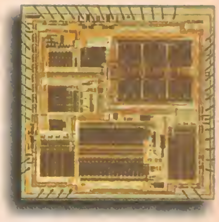
Viewed from the rear, it's pretty clear that the Infinium incorporates a PC. Many of the I/O ports are via standard PCI plug-in cards.

Mind you, very little of this inbuilt digital horsepower is immediately apparent when you turn your attention to the HP 54810A's front panel. In fact initially it seems much more like a traditional 'no brain' analog scope, with very few of the buttons which have tended to make traditional high performance DSOs so intimidating. Each vertical channel has the usual set of gain, position and coupling/input impedance controls, and there's a similarly familiar-looking set of controls for the timebase and trigger functions. The main thing you notice is the lack of a lot of range-scaling legends (the actual settings are always visible on the screen) — plus the nice way in which virtually every push-button control is provided with backlighting, to make clear the current settings.

It's really only when you look at the top of the control area, or the strip beneath the display, that you become aware of the

(Continued on page 96)

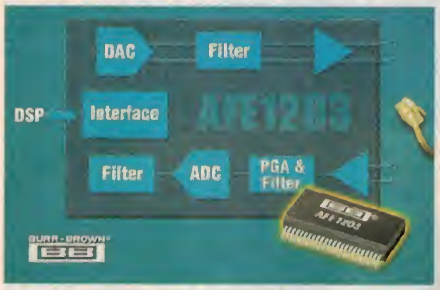
Solid State *Update*



Keeping you informed on the latest developments in semiconductor technology

HDSL analog front ends run at 2Mb/s

Burr-Brown's new complete analog front ends, the AFE1203 and AFE1205, double the speed of single pair HDSL (high-bit-rate digital subscriber line) systems. The devices' scaleable data rate (up to 2.3Mb/s) allows single-pair HDSL users to run twice as much data over a single pair. HDSL technology provides high speed data transfer using existing copper wire infrastructures.



The AFE1203 and AFE1205 greatly reduce the size and cost of single-pair HDSL systems by providing, in a single chip, all of the active analog circuitry needed to connect an HDSL digital signal processor to an external compromise hybrid and an HDSL line transformer (copper wire telephone lines). Single pair HDSL technology is ideal for business orientated T1/E1 services as well as local area networks and Internet servers.

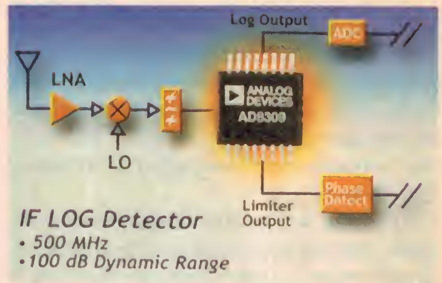
Functionally, the devices consist of a transmit and receive section. The transmit section generates, filters and buffers outgoing 2B1Q data. The receive section filters and digitizes the symbol data received on the telephone line. The units feature user programmable power dissipation (385mW used for operation at 2.3Mb/s) to reduce power consumption when using the unit at lower speeds (down to 160kb/s), to lengthen reach. They operate on a single +5V supply (+5V to +3.3V digital).

For more information circle **272** on the reader service card or contact Kenelec, 23-25 Redland Drive, Mitcham 3132.

500MHz log amplifier

Analog Devices has announced a 500MHz, 100dB logarithmic amplifier, the AD8309. Until now, it required a lot of work to coax the kind of dynamic range engineers needed from their high-frequency transceiver designs. The AD8309 provides both logarithmic and limiter outputs for accurate phase detection in PSK (phase-shift keying) and FSK (frequency-shift keying) applications, including CDMA (Code Division Multiple Access) and GSM (Global System for Mobile communications).

Designed with attention to ease-of-implementation, temperature stability, minimizing of external components, low power and low cost, the AD8309 detects the RF envelope of the signal, so engineers do not have to demodulate it. The limiter outputs provide a hard-limited signal as a differential current from open collector outputs. The output buffer provides an adjustable and temperature-stable output.



The device's 500MHz bandwidth, high accuracy and temperature stability make it well suited for high-speed signal strength measurement in RF/IF applications such as cellular base stations and radar. The bandwidth, accuracy, dynamic range and low noise also make it well suited for applications which require wide dynamic range capability for compression (log conversion) prior to digitization.

For more information circle **273** on the reader service card or contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

Digital filter for 24-bit, 96kHz operation

Burr-Brown's new DF1704 is a high performance, stereo 8X oversampling digital interpo-

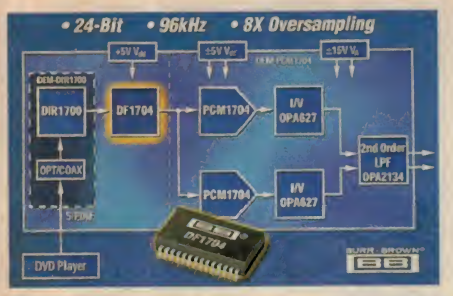
Triple ADC for SXGA LCD monitors

Following quickly on the heels of the AD9483, the first analog-to-digital converter (ADC) optimized for digitizing RGB graphics signals from personal computers and workstations, Analog Devices has released the AD9884. Like its predecessor, the AD9884 has a 140MS/s encode rate, full-power analog bandwidth of 500MHz, and can support display resolutions up to 1280 x 1024 at a 75Hz refresh rate with sufficient input bandwidth to accurately acquire and digitize each pixel.

Among the many new features of the AD9884 are an internal PLL (phase-locked loop) to generate a pixel clock from HSYNC (horizonal sync), an internal +1.25V reference, and programmable gain and clamp control. The device has been designed for demanding RGB graphics processing, LCD monitors and projectors, plasma display panel and scan converter applications.

The AD9884 is a low-cost, single-chip solution for providing an analog interface for flat panel displays. Because the device is a fully integrated analog interface, high image quality is maintained at low total system cost.

For more information circle **271** on the reader service card or contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.



lation filter designed for high-end consumer and professional audio applications. The device supports 24-bit, 96kHz operation and features user programmable functions, including selectable sharp or slow roll-off filter response, digital de-emphasis, independent L/R attenuation, and input/output data formats.

An interpolation filter such as the DF1704 is used to make the reconstructed audio signal truer to the original music, by restoring missing sound information between each sample of the digital-to-analog converter (DAC). The DF1704 is claimed as the ideal companion for Burr-Brown's PCM1704, a 24-bit BICMOS sign-magnitude audio DAC. This combination allows for construction of very high performance audio systems and components.

Specific applications for the DF1704 include high-end CD players, high-end DVD players, digital multi-track and video recorders, and digital effects processors. Moreover, the small package size, a 28-lead SSOP, makes this device well suited for a wide variety of audio and video systems, as well as musical instruments.

The DF1704 features 16/20/24-bit input audio data word, 16/18/20/24-bit output audio data word, 32kHz-96kHz sampling frequency, 256/384/512/768 fs system clock, TTL input interface, -115dB stopband attenuation, +/-0.00005dB passband ripple and single +5V power supply operation.

For more information circle **274** on the reader service card or contact Kenelec, 23-25 Redland Drive, Mitcham 3132.

First reduced charge, asymmetric dual MOSFET

Vishay Siliconix has released the industry's first asymmetric dual MOSFET with a reduced gate charge design, one of three new PWM-optimized LITTLE FOOT devices for notebook and desktop computer DC/DC conversion applications.

The new Si4824DY provides two N-channel MOSFETs in a single SO-8 package, with on-resistance of 17.5mΩ for the first MOSFET and 40mΩ for the second. This new asymmetric device can thus replace with a single package the two individual MOSFETs required in a synchronous buck converter design, reducing component count while also ensuring that on-resistance is at an optimal level for both the switching and synchronous rectification components of the circuit.

In addition to avoiding overkill in synchronous buck designs, the Si4824DY provides an additional measure of efficiency with its reduced typical gate charge characteristics of just 12nC for one MOSFET and 31nC for the other. A first for any asymmetric device, these reduced Qg ratings ensure that power conversion efficiency will be maximized across the full voltage range of the circuit.

Also released by Siliconix were the Si4820DY and Si4822DY, two single N-channel power MOSFETs that provide the reduced gate charge feature at a comparable price to standard devices.

For more information circle **275** on the reader service card or contact distributor Braemac, 1/59-61 Burrows Road, Alexandria 2015.

Analog Switches run from only 2.7V

Two new analog switches offering high-performance operation at voltages as low as 2.7V have been released by Vishay Siliconix. The new single-pole, double-throw DG9431 and DG9461 provide signal routing and signal source selection functions in low-voltage systems, including dual-band cellular phones, portable communicators, test equipment and notebook computers.

Their ability to operate from power supplies ranging from 2.7V to 5V results in lower power dissipation compared to previous-generation devices, thus prolonging battery life in portable systems.

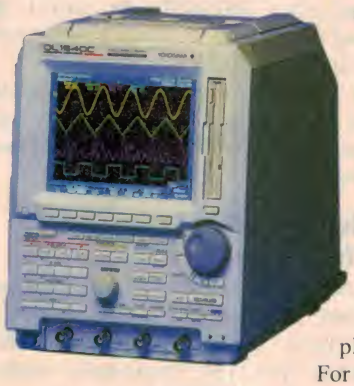
Space savings with the new devices will be significant as well, as both are available in the tiny TSOP-6 package as well as the SOIC-8.

Typical on-resistance is 30 ohms for the DG9431 and 50 ohms for the DG9461, thus adding to the options available to designers. Maximum leakage is a low 200pA, while charge injection is just 1pC. Typical turn-on/off times for both devices are just 50/20ns in 3V applications.

For more information circle **276** on the reader service card or contact distributor Braemac, 1/59-61 Burrows Road, Alexandria 2015. ❖

New Products

Portable DSOs with advanced functions



Yokogawa has introduced two lightweight portable digital oscilloscopes featuring a colour display and advanced functions. Called the DL1540C and DL1540CL (for the long-memory model), the new instruments have a 6.4" colour TFT display featuring a wide viewing angle that allows users to clearly distinguish between waveform data on multiple channels. With four input channels, a maximum sampling rate of 200MS/s, a DC-150MHz analog bandwidth, up to 2M word record length, colour printer output, an optional built-in printer and three-year warranty, the instruments offer very high performance and ease of use.

In two-channel mode the DL1540C can capture signals using a record length of up to 120k words, while the DL1540CL stores signals with a record length of up to 2M words.

Zooming is an important function of any digital scope, especially one with long record length capability. The DL5140C series has a zoom function that can display up to eight traces simultaneously, zooming in quickly and easily on waveform details. Eliminating the problem of which trace to assign the zoom trace, the DL1540C allows the user to display the captured trace and the zoomed trace at the same time.

With conventional digital scopes, the contents of the memory are updated at every trigger so previous waveforms are all lost. However these instruments have a History function which stores the last 100 displays for instant re-call. In addition, a Snapshot feature provides easy comparison of waveforms with just one key operation.

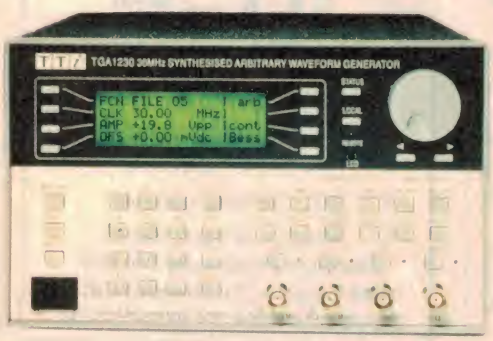
The DL1540C's constant refresh rate of 60/s means that, for real time monitoring, short-term events are not missed and the display quality is unaffected by the number of traces or waveform processing.

For more information circle **241** on the reader service card or contact Yokogawa Australia, D1/25-27 Paul Street North, North Ryde.

Standard & arb function generator

Thurlby-Thandar's new TGA1230 generator combines the functions of a standard function generator and arbitrary function generator. Standard functions including sine, cosine, haversine and havercosine, triangle, ramp and sin(x)/x can be generated with frequencies ranging from 1mHz to 10MHz (with square waves to 15MHz). Setting resolution of frequency is 1mHz or seven digits.

Arbitrary waveforms are definable to 12 bits vertically and 16 bits (65,536 points) horizontally, with the waveform replay clock being variable between 0.1Hz and 30MHz. Up to four different waveforms can be strung together, each repeatable from one count to 32,768. Waveforms can be replayed at user-specified waveform or clock frequencies.



Complex pulse trains in patterns of up to 10 pulses (each with its own amplitude, width, delay) can be defined and replayed at user-defined repetition rates. The arbitrary function capability allows setting of variable risetime pulses.

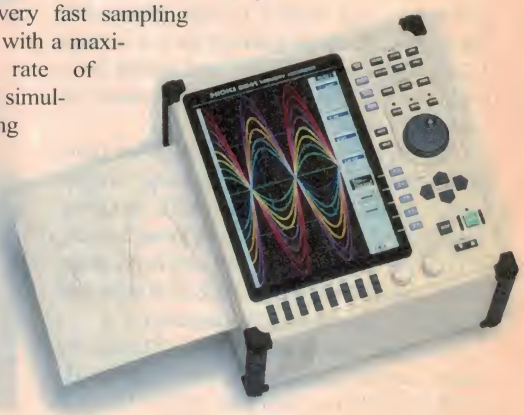
Up to 50 arbitrary waveforms can be stored in non-volatile RAM. These can be downloaded via the standard RS-232 interface (GPIB optional) from a computer or digital storage oscilloscope. Front panel editing controls are provided.

The TGA1230 has a 4-line x 20 character display, and is housed in a half-rack size case.

For more information circle **242** on the reader service card or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066.

32-ch recorder with full colour TFT

The new Hioki 8841 Memory HiCorder is a recording system with a maximum of 16 analog channels and 16 digital channels. It's a very fast sampling memory recorder, with a maximum sampling rate of 1MS/s even when simultaneously sampling 16 analog and 16 digital channels. As such it's claimed ideally suited to tasks such as engine characteristic determination, electrical circuit analysis, circuit breaker maintenance, vibration analysis, moulding machine monitoring and protection tasks such as ground fault detection in transmission lines.



The basic memory capacity of the instrument is 12 bits x 500K words per analog channel (for 16 analog channels), or 4M words per channel (for two analog channels).

The Hioki 8841 has a standard floppy disk drive for file storage in MS-DOS format, and a PCMCIA slot suitable for SRAM card storage (max 32MB) or ATA/hard disk cards (max 528MB). An optional magneto-optical drive with max 640MB storage in binary, text or BMP format is also available.

A broad selection of triggering modes can be employed including in-window, simple level, voltage drop, and RMS value level. Cycle triggering permits monitoring of rising voltage edges while pattern triggering caters for hi/lo logic conditions.

The instrument is equipped with a large 264mm full colour TFT, and full on-screen help displays to guide the operator. The integral thermal printer uses full A4 width 216mm paper, with printout to a standard colour printer being available via a printer card option.

For more information circle **243** on the reader service card or con-

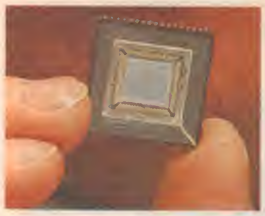
tact Nilsen Technologies, 150 Oxford Street, Collingwood 3066.

Tiny motors are very efficient

Claimed to run longer than competitive DC motors and cost less, the Maxon A-max range incorporates a number of innovative design changes. The new motor housing, which is precision-made from rolled steel, has increased strength while waste material has been minimised to reduce costs. A redesigned commutator with a smaller diameter has an increased number of segments, ensuring a longer operating life, while the elimination of a C-clip groove has provided higher torsional stability and cross-sectional strength.

An improved winding technique has resulted in a high-performance relationship between coil and magnet, and an innovative manufacturing process forms the stator by assembling the motor housing, magnet and end cap in a one-step injection moulding. Either sleeve or ball bearings may be specified.

For more information circle **244** on the reader service card or contact M. Rutty & Co., 4 Beaumont Road, Mt Kuring-Gai 2080. ❖



Silicon Valley Newsletter

Valley CEO quits for Roswell UFO quest

ONLY IN SILICON VALLEY would the founder of one of the most successful Internet consulting and services firms step down from his post in order to use some of the hundreds of millions of dollars he has earned in his company — to prove that an alien spaceship landed in the New Mexico desert 50 years ago and that the United States government has carefully mined the ship for its technology, which has subsequently been introduced into society and is responsible for most of today's high-tech innovation. But that is exactly what Joe Firmage has done.

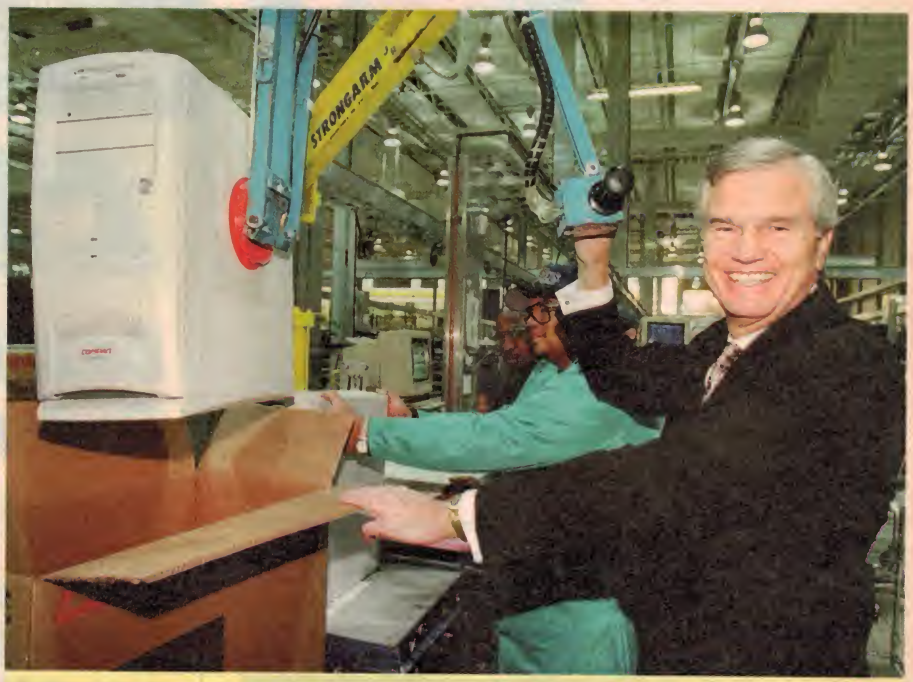
The 28-year-old founder of USWeb announced he is leaving the firm and position of chief executive officer. Firmage said he will now devote all of his time to pursue his search for the truth about the spaceship's alleged crash near Roswell, New Mexico, and the subsequent government cover-up, including the establishment of 'Area 51' in the Nevada desert where the wreckage was allegedly taken for study.

To be sure, Firmage in not your average 'space case', but a bright engineer and executive, founder of two successful high-tech start-ups. His latest, USWeb recently merged with the CKS Internet marketing firm. He admits that his decision to leave USWeb will help shield USWeb and its CKS partner from the ridicule surrounding his wild beliefs regarding UFOs. "I want the company not to be impacted in any negative way."

Firmage said he is willing to risk his career in pursuit of his theories because he believes very strongly in them. He has apparently spent more than a year researching the data surrounding the alleged 1947 incident, and has published his theories in a 600-page document called *The Truth*, available on his Web site (www.thewordistruth.org).

According to Firmage, the US Government has spent decades reverse engineering a wealth of technologies discovered aboard the alien ship. Some of those technologies we take for granted today include fibre optics, lasers and semiconductors, all of which he believes have been carefully and slowly 'leaked' into the industry in order to nudge humanity towards overall technological advancement.

Firmage has plenty of skeptics, including Narinder Kapany, a Silicon Valley scientist. "It is a joke. If not, then I am an alien", said Kapany, who invented fibre optics.



Eckhard Pfeiffer, Compaq Computer's President and CEO, is clearly enjoying himself as he packs the company's 50 millionth personal computer, at their manufacturing plant in Houston, Texas. It was part of a shipment going to Cable & Wireless PLC's US headquarters in Virginia. Currently Compaq's worldwide manufacturing facilities produce up to 50,000 PCs per day. (Business Wire photo)

HP revives Apollo

HEWLETT-PACKARD HAS resurrected the Apollo company, at least in name, with the formation of its new Apollo Consumer Products Inc. subsidiary — a company that will compete in the market for inexpensive colour inkjet printers.

A dominant force in the PC printer market, HP has largely stayed out of the low-end colour inkjet market where companies such as Lexmark have become major players. With the Apollo line of printers, HP will establish a new brand for the first time in its 60-year history. It borrowed the name from the Apollo Computer engineering workstation company, which HP bought in 1989.

HP said that Apollo will start selling printers costing less than US$100 as early as April. The unit is a truly lean operation, with just 10 employees and headquarters in a rented space above a Japanese sushi restaurant in San Diego, a few blocks away from HP's inkjet printer operations. All manufacturing is done through outside contractors such as Kinpo Electronics of Taiwan.

HP hopes to be able to compete effectively in the low-end market where price means everything and brand name is virtually irrelevant. However it doesn't want its prestigious brand name dragged into the low-end dungeons of the printer arena. The only reference to HP on the Apollo printers will be a small message that states 'Powered by Hewlett-Packard inkjet technology'.

In 1998, some 1.4 million sub-$100 printers were sold. That is expected to triple over the next two years.

Microsoft's home networking technology

MICROSOFT HAS stepped up its campaign to plug home appliances, from microwave ovens and sprinkler systems into the electronic networking age, with the announcement of its 'Universal Plug & Play' software that allows any UPP-enabled device plugged into a network to be accessed by any other connected device.

UPP would allow consumers to build home networks in which they will be able to control just about any appliance from a personal computer or other device. They will be

able to print out to a printer from any PC, personal information manager or cellular telephone, or control the electronic timer on their kitchen oven or coffee maker.

"As appliances become more intelligent and the distinction between appliances and computers blurs, a key part of the value to consumers will come from their ability to communicate with other intelligent devices", said Microsoft Senior VP Craig Mundle.

Microsoft will compete in the market for software that runs networks for mixed computers and appliances against Sun Microsystems which has launched the Jini Java-based operating system, which does virtually the same as UPP. Sun has announced that PC vendor Toshiba, disk drive makers Seagate and Quantum, and printer makers Canon and Epson will incorporate Jini into their products. Microsoft said it has lined up UPP support from Compaq, Dell, HP, Intel and 3Com.

Smaller DRAM chips

TOSHIBA, SIEMENS and IBM have jointly developed the world's smallest 64-megabit dynamic random-access memory (DRAM) chip. Using 0.175-micron processing technology, the chip is 40% smaller than similar DRAMs on the market today.

Toshiba plans to start mass-producing the new DRAMs in Japan in late 1999, then transfer the technology to its joint venture plant with IBM in the United States. Toshiba currently has the capacity to produce five million 64Mb DRAMs per month. The new process with enable the company to increase production and lower production costs by about 20%.

LG sells off chip business

THEY WERE UNWILLING to relinquish key management positions in the combined LG Semiconductor and Hyundai semiconductor operation planned by the Korean government. So instead, LG Group decided to relinquish all ownership in the unit.

LG said it had agreed to sell the chip unit to Hyundai rather than accept a minority role as had been proposed in the government-brokered deal. "It is all or nothing", said Kang Yu Shik, who is in charge of structural reform efforts at LG Group. LG's chip operations were valued at around US$800 million. Instead of a large payment, it will receive a percentage of the estimated $6.2 billion in business the combined unit is expected to generate over the next five years.

The LG-Hyundai megadrama finally came to an end when the Korean government ordered banks to withhold fresh loans from LG, to break its resistance to the merger.

Meanwhile, Japanese semiconductor manufacturers, including Hitachi, NEC and Toshiba said they are likely to see their earnings improve, thanks to a combination of rising prices resulting from strong demand for PCs, especially in the US, and slowly evaporating excess memory inventories and industry capacity.

Also on the rise are the fortunes of the chip equipment industry. Stocks of companies such as Lam Research, Applied Materials and others have shot up sharply, on expectations they will cash in this year on rebounding demand for high-end semiconductors.

Silicon Graphics unveils Wintel systems

SILICON GRAPHICS HAS taken the wraps off its much awaited Windows NT-based workstations, which combined with the company's acclaimed 3D graphics technology, puts the same power that created special effects for some of Hollywood's biggest blockbuster movies within reach of graphics design professionals, hobbyists and high-end consumers. The stylish NT and dual Pentium II-based computers start at US$3995. The SGI 320 and 450 are the first SG computers that don't run on Unix and SG's proprietary RISC processors.

"With the introduction of these powerful new visual workstations, professional high-end graphics and media are now accessible to a much broader customer base, at incredibly affordable prices", said Rick Belluzzo, who left the No.2 spot at HP last year to take over as CEO at Silicon Graphics.

At Adobe Systems, VP Bryan Lamkin gave a ringing endorsement to the new SG systems. "Our graphics professional customers will be elated by this news. Now they can combine powerful design and imaging tools with an equally powerful computing platform."

The SGI 320 is powered by two Intel Pentium chips and has one gigabyte of memory. The SGI 540 model has with twice the power and memory of the SGI 320 and is priced at US$5995.

Fairchild acquires Samsung division

FAIRCHILD SEMICONDUCTOR, the recently resurrected granddaddy of the Silicon Valley chip industry, has agreed to pay US$455 million for a consumer electronics IC division of Korea's Samsung Electronics. Samsung's Power Device Division, which employs some 1200 people, makes chips for products such as toasters, coffee machines, television sets, VCRs and audio systems. The unit also produces a line of chips that regulate power supplies for devices such as lighting fixtures and automatic car seats.

As part of the deal, Fairchild's parent company National Semiconductor will take over control of unit's Bucheon, South Korea plant. Also included are the unit's advanced IC design operations. The sale is Samsung's latest in a series of semiconductor sell-offs and mergers. ❖

DVD sales take off

1998 PUT TO REST any concerns that digital video disks (DVDs) would end up with quadraphonic stereo and laserdisc players as a flop, at least in the US consumer electronics market. According to the Consumer Electronics Manufacturers Association (CEMA), 1.5 million DVD players, including DVIX systems, were shipped in 1998, compared with 349,000 in 1997.

More than nine million DVD movie titles were also sold last year, up from 1.5 million in 1997, according to VideoScan, which tracks the DVD video market. No fewer than 2300 movies are now available in the USA on DVD. The best selling titles were *Tomorrow Never Dies* (James Bond), *Godzilla*, *Air Force One*, *US Marshals* and *Lost In Space*.

The jury is still out on the market potential for DIVX, of which some 90,000 units were sold — mostly through the Circuit City chain of consumer electronics stores, which is one of the chief financial backers of the DVIX format that lets consumers 'rent' a movie title instead of having to buy it. But analysts remain skeptical about DVIX's market potential.

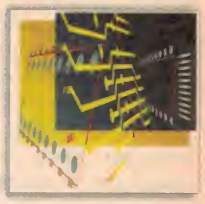
Most retailers are not carrying DVIX, in part because by selling the systems they would be strengthening competitor Circuit City. And two of the eight major Hollywood studios, Warner and Columbia Tri-Star, have not provided content for DIVX, because they say DVDs give consumers more freedom.

HDTV to boom?

ACCORDING TO market analysts, we can expect prices of HDTV sets to come crashing down in 1999. Digital broadcasts started officially on January 1 in the United States.

HDTV sets, sporting the ideal 16:9 aspect ratio and screens of 35" or larger start at around US$4000. But with Japan's economy slipping steadily further down the hill, the country's electronics industry will have little choice but to push HDTV prices down in order to kick-start a mass market that Japan needs so desperately to get its consumer electronics industry back on its feet.

Of course rock bottom in big-screen HDTV still means consumers will be shelling out around US$2500-3500 for the average set. But many analysts believe the number of American consumers willing and able to take the jump to HDTV at that price range is still quite large.



Electronics Workbench Layout

With any luck, you are quite familiar with Interactive Image Technologies' Electronics Workbench, one of the most popular circuit design and simulation packages around. Now there's EWB Layout, a PCB design package that can take your design straight from Workbench, and take it through the final production stage and out into the real world.

by Graham Cattley

PEOPLE HAVE been designing printed circuit boards for over 25 years now, and we've seen a progression from the steel-nibbed pen and India ink, through the 'tape and donuts' era to the far more civilised CAD systems in use today. This change in technology though, brought with it a change in the concept of PCB design. No longer is it a case of simply laying down tracks — many of today's PCB design packages are part of massive EDA design and schematic capture suites, where the final PCB artwork is the result of a long chain of computer simulation and optimisation.

EWB Layout is a package that brings Electronics Workbench in line with other EDA suites by providing a PCB design 'back end' to the well-known circuit simulation package. With EWB Layout installed, the complete design can be produced in the one environment — initial circuit design, circuit simulation and testing, re-design and optimisation, and finally production of a fully annotated schematic and circuit board. It is then a short step to producing a real-life prototype that will perform as designed...

The ability to do all this in the one design suite is of great benefit, as even the simple job of maintaining annotation between schematic and PCB can be a real nightmare when you are dealing with more than one piece of EDA software.

Upgrade needed

EWB Layout is essentially a 'plug-in' for Electronics Workbench, and it seamlessly integrates itself into your existing EWB installation. Or it does if you are running EWB version 5.12 or higher. As it turned out, I was running V5.0C, and so had to get in touch with the suppliers to get them to mail me an upgrade. (There was an upgrade available on the EWB website, but for some reason it only applied to the student version.)

The upgrade consisted of a CD containing an entire new installation of EWB, and required a serial number before it would start. As none was supplied, I used the one from my original 5.0C version (luckily, I had written it on one of the installation floppies) and it seemed to be happy to let me proceed.

I mention this serial number business because strangely enough EWB Layout comes with its own form of copy protection: a dongle... I groaned when I first saw it, as I remembered the problems we've had in the past with dongle-protected software. So it was with some trepidation that I installed EWB Layout (along with EWB 5.12) on my home machine, a K6-2/300 with 64MB RAM and running Windows NT4. After the initial install-and-reboot procedure, Layout detected the (Hasp) dongle and started up perfectly.

Still a bit wary, I tried printing a large colour image on my inkjet, in case the dongle would seize up the system and justify my pessimism. It didn't, of course, and it seems as though my fears were completely unfounded. It made me wonder, though, why it was deemed necessary to slug Layout with such a cumbersome (and expensive) copy protection scheme — it is effectively just a plug-in for Workbench (which *doesn't* have a dongle), and will really only be of use to top-end design teams and not your average hobbyist. If they are happy to release the hugely popular Electronics Workbench out into the world with only a simple serial number system, why all this fuss with the dongle?

Maybe it has something to do with the price: at $3988 for the Power Professional version, they're probably more worried about wholesale commercial piracy than the odd disk swapped between friends...

Features

EWB Layout offers all the layout and routing functions you'd expect from a professional PCB package, and as it is inherently linked into Workbench, useful features such as back annotation are supported as well.

It will route boards up to 50" x 50", and supports up to 32 layers. The internal autorouter uses the Lee algorithm, and is reasonably fast. In the Professional Power Pro and Educational versions of Layout you also have the option to use an external autorouter, which uses a grid based 'Rip-up and Retry' method. This is slower and gives you fewer routing options, but is better suited to high density boards.

Of course, the ability of an autorouter to fully complete a board is entirely dependent on the relative position of each component. It is therefore quite an art to position every component in the right place, and so it is good to see that Layout has a couple of nice tools that can help in this task. The first is a display of 'Force Vectors' for every component. These are arrows showing the direction of the 'optimum' component position on the board, and are quite useful when trying to untangle the initial ratsnest of component interconnections.

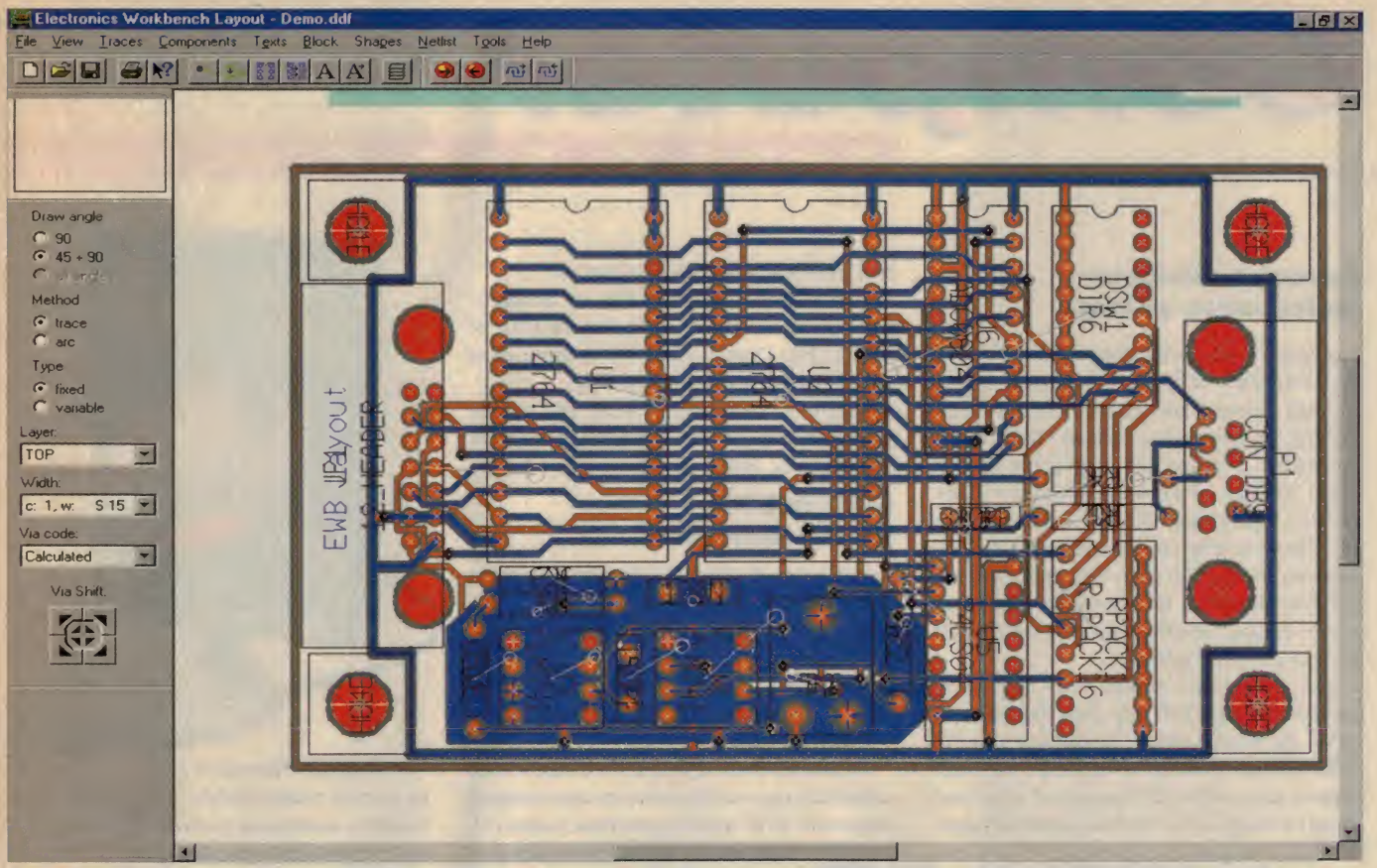
The other helpful feature is the ability to call up a histogram of track density for the PCB. With this you can quickly spot the bottlenecks on the board and shuffle the components around to suit.

Layout will output the final board artwork as a standard Gerber plot or Excellon drill file, as well as HPGL/DPMI and Windows (GDI) printers.

The 120-page manual covers everything quite thoroughly, and also includes a brief tutorial covering the progress from a schematic loaded in to Workbench, through to a completed four-layer PCB. There's sign of a little hasty editing in the manual, with the odd wrong word or incorrect diagram, but it's nothing serious.

Some problems

As well as the internal and external autorouters, there is also the option to use the SPECCTRA autorouter as well. The trouble is



In this screen shot you can see the force vectors (thin grey lines) on each component showing the direction of the 'optimum' position of that part. The buttons along the top row offer basic file functions, the two track editing tools and autorouter import/export.

that when I tried to use it, I was informed that the Hasp licence wasn't valid, and so SPECCTRA wouldn't start. I could find no mention to SPECCTRA in the user manual and only a few oblique references to some SPECCTRA settings in the online help. As I was using a relatively early version of Layout, I can only assume that the SPECCTRA licensing hadn't been finalised in the version I had for review.

The literature supplied with Layout mentions 'powerful interactive editing' tools, but these don't seem to apply to manually laying tracks — there isn't any way to move the end of a track, and you can't insert a node into an existing track. Come to that, there aren't any node editing tools at all; you can only shift an existing track left, right, up or down, and Layout decides if an extra node needs to be inserted. Quite annoying, as sometimes the only way to get the track to go in the right place is to delete it and lay down a new track.

I also found the manual editing tools fairly cumbersome to use, and felt quite hampered by the number of requesters and OK buttons to click. An example of this is the procedure you have to go through in placing a new component. You have to select New from the Components menu, select 'Library' from the Shape Source requester, highlight the library containing the component, select the desired component from the list, click 'Show' to verify that you have the right one, click 'OK' to close the preview box, enter the component ID and value, and then click the final 'OK' button. Positioning the component involves pressing F2 to rotate, clicking to finally place it on the PCB, and then clicking OK to another pop-up requester.

You then have to go through the two-stage process of incorporating the new component into an existing net, and then actually drawing in the traces. The first process involves selecting nets and defining pins, while the second is a little more straightforward.

OK, maybe I'm being a little unfair here, as you should ideally go back to your schematic and include the component there, whereupon it will filter through the export process and arrive ready to go on the board, but the whole process really could have been much simpler.

Summary

All in all, I think that you'd be best off treating EWB Layout as a PCB export filter for Workbench, and rely on setting the myriad of design rules and autorouting parameters to generate the desired board. I say this because Layout doesn't offer any form of import or export in other PCB file formats other than its own. It can load and save an ASCII netlist, however, but when importing you'll need a separate component list that matches Layout's component library.

I suppose I've been a bit negative in this review of EWB Layout, and this is probably due to my initial assumption that Layout was a stand-alone PCB editor with autorouting facilities. Instead it is very much a bolt-on PCB generator for Workbench, which does put in in a different light.

You aren't necessarily up for thousands of dollars, either — Student versions are available for as little as $129 (300 pins max, internal autorouting and no Gerber export). So in light of that I'd say that if you use Electronics Workbench as the basis of your designs, EWB Layout will let you follow through with PCB design that will help bring your circuit out into the real world. ❖

EWB Layout

A PCB design package which mates with Electronics Workbench.
Good points: *Integrates well with Workbench, and supports back annotation to the original circuit. Free technical support from Emona.*
Bad points: *Very limited import and export facilities. Manual editing is clumsy, few track editing tools.*
RRP: *$3988 for the Power Professional version, down to $129 for the Student version.*
Available: *Emona Instruments, PO Box 15, Camperdown, NSW 2050; phone (02) 9519 3933 or fax (02) 9550 1378. Email testinst@emona.com.au, website at* ***www.emona.com.au***

Computer

News & New Products

Powerful non-linear digital video editing

Canopus' DVRex-M1 for Windows 95/98 and Windows NT is claimed as a breakthrough capture and editing solution supporting DV and analog formats (IEEE 1394, composite, S-Video and component Output only) through a software optimised Sony DVBK-1 hardware CODEC and advanced PCI interface implementation. Aimed at the semi-professional to professional market, the DVRex-M1 offers an affordable non-linear video editing solution without sacrificing performance and quality.

The DVRex-M1 breaks new ground by overcoming the 2GB file size limitation of .AVI, the most common format used for PC video editing. With the DVRex-M1, users can capture up to 4GB (20 minutes of audio and video) into one .AVI file and seamlessly capture video footage for as long as you have hard disk space, in one single pass. The DVRex-M1 also incorporates multi-channel audio processing and mixing for the most crystal clear audio output.

This new generation in hybrid non-linear video editing allows you to work with both analog and DV formats without having two separate editing boards in a computer. In addition, Canopus has made it easier to capture and edit in native DV audio and video by including RexEdit software that features a timeline interface with real-time capabilities.

For users who have hours of existing analog video they want to combine with new DV footage, the DVRex-M1 permits them to mix analog footage (S-Video or composite) with DV material for either DV or analog productions (including component output — i.e., BetaCam SP). RexEdit software allows the users to convert their analog into DV in real-time with the push of a button.

The Canopus DVRex-M1 is available from distributor Lako Vision at the RRP of $5600. The Digital audio M2 module is an optional extra and sold separately.

For more information circle **160** on the reader service card or contact Lako Vision on (03) 9852 7444.

SCSI to SCSI RAID Subsystems

Advantech's RAID-800S RAID (Redundant Array of Independent Disks) subsystem provides a high performance SCSI-to-SCSI RAID architecture. Up to seven 3.5" SCSI HDDs can be grouped to function as a medium/large capacity single disk RAID unit, independent of the host system.

The RAID-800S disk array is a stand-alone subsystem that can be driven by any standard ultra-wide SCSI adapter card from a host PC. No special OS software driver is needed, so there are no compatibility problems.

The RAID-800S's array subsystem protects against disk drive failure, allowing one HDD failure without affecting the system's data integrity. A failed HDD can be hot-swapped with a good HDD on-line, and any lost data will be automatically rebuilt in the background without disturbing system operation. Users can also specify one of the HDDs as a spare, thus enabling the RAID-800S to use the spare HDD to recover data automatically should a failed HDD be detected.

For more information circle **161** on the reader service card or contact Priority Electronics, 189 Bay Road, Sandringham 3191.

Mouse-trackball combo

Logitech has released the Marble Mouse, an innovative pointing device that combines the best features of both mouse and trackball. Based on Logitech's award-winning Marble sensing technology, Marble Mouse is claimed to offer unmatched precision and reliability in an essentially maintenance-free unit.

Users rest their hand on Marble Mouse as they would on any mouse, but achieve cursor motion and scrolling by rotating the high-precision Marble trackball instead of moving the mouse around the desk. Available from Logitech dealers and distributors at a RRP of $99.95, Marble Mouse supports Windows 3.1, '95, '98, or NT.

The device features a gently curved shape designed to provide comfortable, convenient control of the trackball and buttons for both right and left-handed use. Installation is easy - simply plug Marble Mouse into a serial or PS/2 port on any Windows system and begin working immediately, without needing to install any additional software.

Logitech's patented Marble technology uses advanced optics to detect movement in a manner similar to that of the human eye and transmit this information to the computer. In a Marble device, a laser-like beam illuminates a random pattern of dots printed on the ball, while an optical sensor tracks the motion.

For more information circle **162** on the reader service card or contact Logitech Australia, Level 2, 633 Pittwater Road, Dee Why 2099.

Multichannel fibreoptic transmission system

Optical Systems Design has announced its OSD690 series multichannel video/audio/data fibre optic transmission system, which supports up to 16 video, high quality audio and RS232/RS422 data channels on one single-mode fibre and up to 32 channels with the addition of an expander frame.

The system is designed primarily for real time closed circuit television system and remote learning applications and offers extremely cost-effective transmission over distances to 30km. While primarily designed to operate in point-to-point links, it can also distribute the same basic set of channels to several scattered sites when used with OSD supplied optical splitters.

Single-mode fibre is necessary for the highest performance, but the system will carry a limited mumber of channels over shorter distances when using multimode fibre. In either case, the OSD690 normally operates at a wavelength of 1300nm, but can be supplied for 850nm operation should this be imposed by system constraints or by specialized industrial or military connectors.

For more information circle **163** on the reader service card or contact Optical Systems Design, PO Box 891, Mona Vale 2103.

Professional version of 19" monitor

Hitachi Australia has announced its latest monitor, designed specifically for power users wishing to conserve space. The Hitachi CM753 is a high-quality, high resolution 19" monitor with higher specifications than the superseded CM751.

A maximum resolution of 1600 by 1200 at 85Hz refresh, ensures a flicker free display for even the most sensitive user. According to Hitachi the CM753 is ideal for use with today's high resolution graphic cards, allowing multiple pages or windows to be opened on the desktop with stunning clarity. Setup is easy, with the built-in screen based display accessing some 26 modes with digital storage.

The CM753 uses the latest in Hitachi developed CRT technology, incorporating a 19" diagonal tube (367 by 276mm viewable area) featuring an Advanced Elliptical Aperture electron gun with Multistep Dynamic Focusing, 0.22mm dot pitch and Invar shadow mask that collectively achieve high brightness and precise focus right to the screen edge.

A newly developed high performance deflection yoke provides high quality convergence, less distortion and reduced magnetic leakage. The monitor is only about 25mm bigger in all external dimensions than a typical 17" monitor, yet is an impressive 76mm shorter and narrower than a typical 21", and more importantly, is 100mm less deep.

The Hitachi CM753 is available from Hitachi monitor dealers Australia wide, for an RRP of $2955. For more information circle **164** on the reader service card or contact Hitachi Australia, 13-15 Lyonpark Road, North Ryde 2113.

Tiny joysticks are force operated

Penny + Giles has developed a range of rugged, miniature force operated joysticks, particularly suited to applications where high levels of shock and vibration are found.

The range of miniature force operated joysticks (stiff sticks) provides the operator with rugged, small footprint positional controllers. Strain gauge elements are bonded directly to the joystick shaft, sensing force and direction. This configuration gives an infinitely variable output, with effectively no moving parts, and high reliability. Stiff sticks are well suited for mobile applications where shock and vibration are a problem, harsh environmental conditions apply or simply where space is at a premium.

Versions using either semiconductor or foil strain gauges are available. Semiconductor devices offer the advantage of high outputs, whilst units incorporating foil strain gauges offer exceptional stability over extended temperature ranges. Signal conditioning/amplifier boards are available for both types, and they can be supplied with interface cards giving standard mouse compatible outputs.

For more information circle **165** on the reader service card or contact Control Devices Australia, Level 1, 150 William Street, East Sydney 2011.

Computer

News & New Products

SCXI signal conditioning modules

National Instruments has announced two new modules for SCXI signal conditioning systems. The SCXI-1104 solves mid-level voltage analog input applications, while the SCXI-1127 offers matrix/switching solutions. The modules offer new capabilities that help engineers and scientists create high-performance, flexible computer-based measurement and automation systems using the company's data acquisition (DAQ) hardware and LabVIEW or LabWindows/CVI software.

The SCXI-1104 is a 32-channel multiplexer that can read voltage levels up to +42V, for applications where users

want to monitor signals just outside of the working input range of a DAQ card, such as 12V or 24V signal sources. Each SCXI-1104 module multiplexes the 32 conditioned signals into a single channel of the DAQ board or module. Used together, several SCXI-1104 modules can multiplex hundreds of inputs into a single channel on a DAQ board or module. Each channel of the SCXI-1104 includes precision attenuation circuitry, an instrumentation amplifier, and lowpass noise filter, and can operate at up to 333kS/s.

The SCXI-1127 is a high-density armature relay device that can act as a multiplexer or matrix module for the SCXI platform. As a multiplexer, the SCXI-1127 can operate in different multiplexing modes including 1-wire for large channel-count systems, 2-wire for differential pair systems, or 3- and 4-wire modes for resistive measurements including RTDs and thermistors. With SCXI front-mounting terminal blocks the SCXI-1127 operates as an 8x4 2-wire matrix switching module or as a 32x1, 2-wire multiplexing module. Expanding the matrix or multiplexer channel count is as easy as adding additional modules.

For more information circle **167** on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

Hands free voice transaction computer

Telxon has added a hands-free, eyes-free, mobile transaction computer to their lineup of high quality automatic data capture products. Designed primarily for manufacturing and

distribution operations, the VTC-303 enables workers to communicate effortlessly with their warehouse or manufacturing automation systems through advanced speech recognition and speech synthesis technologies.

Rather than using a traditional keyboard and display to enter and receive data and commands, workers use the easiest and most efficient method available: speech. This leaves hands and eyes free to continue work.

By eliminating the data entry operation the VTC-303 saves time, reduces labour costs and eliminates errors. Further, the combination of speech recognition, bar code input and radio communications technology makes data available to everyone who needs it in real time. The unit is small and lightweight at just under 1kg, including the battery, and is worn on a belt around the user's waist in conjunction with a cabled headset.

For more information circle **166** on the reader service card or contact Telxon Australia, Unit C, 55-61 Talavera Road, North Ryde 2113. ❖

Test Instrument Review

(Continued from page 85)

instrument's 'digital goodies'. For example at the top of the controls you find the floppy disk drive, plus the magic 'Autoscale' setup button and the other acquisition system controls. Similarly under the display there's the measurement cursor control buttons, plus another magic button marked 'Quick Measure'. This one achieves for measurements what the Autoscale button achieves for setting up a stable, clear display of unknown signals — so often, all you need to do is press Autoscale, followed by Quick Measure.

Manual unnecessary

When it comes to actually driving the Infinium, I'd been using it for a couple of hours to make various measurements, on various kinds of signals, when I realised that I hadn't even looked for the user manual. I simply hadn't *needed* to refer to a manual, because (a) the scope was so intuitive to drive, and (b) when I did need to clarify anything, it was simply a matter of a few mouse clicks to call up the necessary on-line help advice...

In fact, it was only when I decided to look for the manual out of curiosity, that I found it: a compact little volume called the *User's Quick Start Guide*. But I also found a double-sided colour poster, showing in a few simple steps how to set up your Infinium and run its inbuilt demo presentation. This is really all you need, anyway.

As it happens there are some other manuals that come with the scope, but these are basically programming manuals for users who want to develop their own automated testing routines, etc.

In terms of getting the Infinium to display many different kinds of signal and perform all manner of measurements, I found its operation very friendly and intuitive. That mouse-driven Windows 95 interface makes an enormous difference, believe me — as does the colour coding between controls and traces.

Needless to say I couldn't fault the scope's actual performance, either. It's a superb high-end measurement tool, as you'd expect.

At present all of this measurement horsepower and user friendliness doesn't come cheaply, of course. The HP 54810A Infinium will currently set you back a cool A$20,813 — but if you need this kind of performance, this is not unreasonable considering all of the other built-in features. Hopefully now that they've cleared the technology hurdles to produce the Infiniums, HP's engineers will soon be able to provide at least some of the same benefits on the lower-cost instruments. ❖

Web watch

by Graham Cattley

A READER Derek Logan recommends The Free Online Dictionary of Computing at **http://wombat.doc.ic.ac.uk/foldoc/index.html**, which contains over 11,000 definitions of (deep breath): acronyms, jargon, programming languages, tools, architectures, operating systems, networking, theory, mathematics, telecoms, institutions, companies, projects, products, history, and in fact just about everything to do with computing.

It currently handles 10,000 queries per day. So if you need to know what an Avatar is, or want to know about Open Document Architecture, I suggest that you go and make that 10,001.

YOU CAN'T TALK about net-based computer dictionaries without mentioning the Jargon File, which you will find at **http://www.tuxedo.org/~esr/jargon**. The Jargon File is one of the largest and most interesting computer lexicons on the net, as it contains not only the explanation of the word or phrase, but also its origin.

Scattered throughout this huge dictionary are stories, folklore and detailed explanations covering just about every conceivable aspect of computing, and as the whole lot is hyperlinked together it's easy to start wandering off for hours looking up the famous walking drive, or what really happened when you pulled the Big Red Switch.

Oh, and if you program for a living, you *must* look up The Story of Mel and read about a Real Programmer...

THE NINTENDO GAMEBOY has become quite a popular item in recent years, but what you may not realise is that inside that slim handheld case is a normal everyday CPU (similar to the Z80), a 160 x 144 LCD screen, a serial com port, provision for plugging in your own RAM and ROM, and it all runs of two AA batteries!

Needless to say, a number of people have put the GameBoy to use in many varied and useful ways, including a sonar fish finder, MIDI processor and of course the inevitable robots. Jeff Frohwein's GameBoy Tech Page at **http://home.hiwaay.net/~jfrohwei/gameboy** is an ideal starting place in getting GameBoy schematics, emulators and even programming languages (including GB BASIC!).

There's lots of hardware info, including details on making your own cartridges and interface cables, as well as things like making your own four-player adapters. Oh, and as you might imagine, there are tonnes of programs to download too. This site is also part of a GameBoy Webring, so if you find it interesting, go off and explore some of the other sites on the subject.

IF YOU ARE INTO digital electronics, then you're missing out big time (as they say) if you haven't heard of Clive Maxfield and his series of books on the subject. Dean McKenzie suggested that I look at Clive's site at **http://www.maxmon.com**, where I found a fair amount of useful stuff. The site pushes the various books that Clive has produced over the years, (which is a good thing really, as they are some of the best I've seen on the subject), but if you poke around a bit you'll find a couple of digital circuit simulators to download, a library containing a number of useful articles, and even a newsletter. You'll also find a couple of recipes for seafood gumbo and pickled onions, but of course, that's Clive all over...

ROBERT ST-LAURENT in Canada came up with Gray Creager's home page at **http://www.scruz.net/~gcreager**, where among other things you'll find a listing of over 620 IC manufacturer's website addresses. Gray seems to update the list quite regularly, and he also maintains a list of semiconductor companies that have been bought out or otherwise acquired, to help you find the right site. He even keeps a list of companies who *don't* have a website, so all in all, this is a good place to check if you are looking for a particular manufacturer, or if you can't seem to find their site on the web.

CONFUSED BY DVD? All those regional codes or 'Locales', the need to 'flip' disks or not, the dreaded Divx format — it can all get a bit complicated. If you aren't up to date with all the various formats and acronyms, then hop along to **http://www.videodiscovery.com/vdyweb/dvd/dvdfaq.html** where you'll find the DVD Frequently Asked Questions list. Actually, it is more an every-question-you-can-think-of list, so it's worth perusing, especially if you are planning on buying a DVD player in the near future. ❖

EA Directory of Suppliers

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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KEY TO CODING

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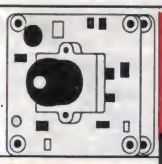
with 1 of these lenses
3.6mm-92 deg./4.3mm -78 deg. 5.5mm60 deg.
Special introductory Price of just $189



**** CCD CAMERA SPECIAL ****
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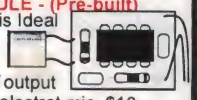
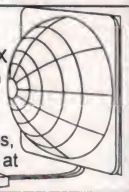
The best "value for money" CCD camera on the market! 0.1 lux, High IR response & hi-res. Better than most cheaper models.
42 X 42mm $89...
32 X 32mm $99...
With 1of these lenses (60deg.), 78 deg.; 92 deg.; 120 deg. or for pinhole (150 deg) add $10

MINI AUDIO MODULE - (Pre-built)
This amp/pre-amp is Ideal for use with our cameras. 12Vdc, Hi sensitivity, 0.6W output operation includes electret mic. $10



4 CHANNEL VIDEO SWITCHER KIT
This kit can switch manually or sequentially up to four audio / video sources. Other features inc. VCR relay output to switch STOP/REC, can be switched with PIR or alarm system inputs Add a security channel to your TV using a UHF modulator, watch TV and just flick channels to see who's at the front door or what the Kids are doing in the yard. This unit can be switched auto-matically using the PIR units below. Kit +PCB + all on-bourd components inc. 18 relays. For less than Half the price of most units at $50 Optional VHF modulator/mixer $18

MINI PIR DETECTOR PCB MODULE (G66)
Professionally built 30mmX 34mm PIR module with an attached Freznel lens and cable with 4 pin connector Ideal for switching cameras, alarms etc. bargain priced at jist: $18



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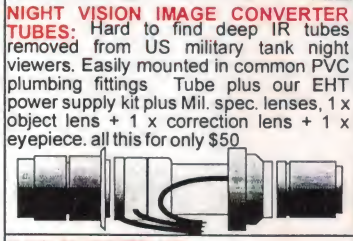
With strong universal swivel mount & 50X50X50mm housing:10 LED $10... 30 LED $20...80 LED $36

NIGHT VISION IMAGE CONVERTER TUBES: Hard to find deep IR tubes removed from US military tank night viewers. Easily mounted in common PVC plumbing fittings Tube plus our EHT power supply kit plus Mil. spec. lenses, 1 x object lens + 1 x correction lens + 1 x eyepiece. all this for only $50



DOG SILENCER KIT:
We have a new improved high power, swept ultrasonic generator kit that can drive up to 4 piezo tweeters. Works on dogs, most animals, rodents and possibly on some bugs etc. kit inc.PCB with all on-board components and a horn piezo tweeter: (K112) $29
Additional Piezo Tweeters (AP1) $4 ea (One is good, but up to four can be used)
Suitable DC Plugpack: (PP12) $10

FREE Ask for a free tunable balanced mini VHF Astec brand Hi quality modulator with any camera order. Connection Diagram supplied

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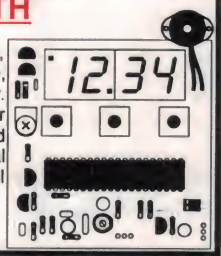
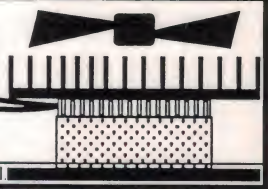
KITS OF THE MONTH

CLOCK WITH CALENDER AND TIMER
12V DC 12Hr. clock for automotive / domestic/ timer use, large (13mm) Green LED display, AM-PM indicator, Date, Month, 24Hr. Alarm, 59 Min. sleep timer, back up battery. Xtal controlled 50Hz (20ms) clock can also be used for CRO calibration and inverters. Can switch external load during Alarm/timer, 0.5A load directly, or 10A with additional MOSFET, Alarm piezo speaker provided. PCB and all comp's kit: $14...Small Piezo speaker to suit $1 extra
Suitable surplus box + swivel mounting/+12A mosfet: $4
Full data sheet for LSI IC used (MM5382): $0.80

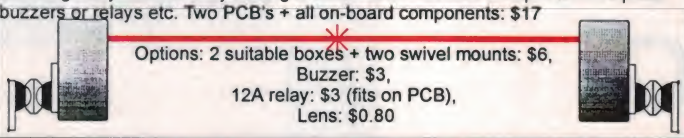


PELTIER EFFECT DEVICES
Make a solid state food cooler / warmer for the car etc. with 2 heatsinks, a fan and one of the following. Could be used for cooling overcolcked PC CPUs
4A ΔT 65deg. 40 X 40mm Qmax 42W $25
6A ΔT 65deg. 40 X 40mm Qmax 60W $27.50
8A ΔT 65deg. 40 X 40mm Qmax 75W $30
Device comes with instructions to build cooler / heater plus data. Some used surplus heatsinks avail.



PELTIER DEVICE CONTROLLER This kit is a switch-mode design to correctly control the temperature of peltier devices up to 10A (very efficient design) PCB plus all onboard components plus new surplus case. $15

SHOP MINDER / IR FENCE
IR transmitter and receiver kits (two separate PCB's), basic range is up to 20M but can be greatly increased by adding a lens. Features include output to drive piezo buzzers or relays etc. Two PCB's + all on-board components: $17



Options: 2 suitable boxes + two swivel mounts: $6,
Buzzer: $3,
12A relay: $3 (fits on PCB),
Lens: $0.80

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BRIDGE RECTIFIERS
35A 400V. Just $4

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Based on a low noise (2.8dB noise figure) & wide bandwidth (2GHz) amp IC (MAR-6), this kit can be used as an active TV antenna. The PCB is divided into two sections. The PCB can be cut so that the supply board can be indoors. The MAR-6 available separately $4. The amplifier produces good results with any two metal wires or strips acting for the antenna. It should even work with a coathanger ! Basic kit with both the PCBs & all on-board parts (K03) $15 Basic Kit + 2 Weather-proof Plastic Boxes + plug-pack: $24 (ask for your free case with this item)

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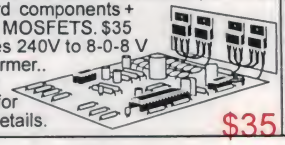
VISIBLE LEDs...5mm
14 X Yellow clear...6 X Red (clear) 24deg....2 X Yellow LED (clear) 24deg. 16 X Red LED (clear) 24deg...38 X Green LED (clear) 24deg.

3mm
14 X Red LED diffused 70deg.
4 X 3mm or rect. Yel. LED diffused 70deg

SPECIAL
1 X 5mm IR LED blue...3 X 3mm Clear Phototransistor...3 X 5mm Clear Phototransistor...1 X IR Receiver module

12VDC - 240AC INVERTER Features include modified square wave output, Auto start with load sensing, Uses six power MOS-FETS with minimal heatsinking required. 200 - 600VA. Dependant on trans former size. To save money you can use an rewind your own transformer. Basic kit includes pcb & all on-board components + 4 X 60A MOSFETS. $35 Requires 240V to 8-0-8 V Transformer.. Ring or E-Mail for More Details.



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COMPUTER CONTROLLED STEPPER MOTOR DRIVER KIT
can drive larger motors, Has optolsolation. Inc. Software & notes: $40 Or $50 with two Used 23 frame 200 step 1.8 Deg. motors!!

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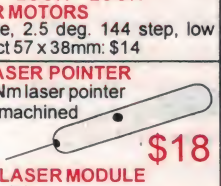
NEW 60 SEC. VOICE RECORDER KIT
This kit has features like multiple messages random message access for play and record and many other user selectable options $29.

****LOOK** LOOK** LOOK****
NEW STEPPER MOTORS
30 oz./in. torque, 2.5 deg. 144 step, low voltage, compact 57 x 38mm: $14

KEY-CHAIN LASER POINTER
Very bright 650Nm laser pointer in a high quality machined metal housing



$18

VERY BRIGHT LASER MODULE
650Nm laser module as used in the above pointer. (Lm2)

$14

NSW new laws may apply soon

IRF460 MOSFETS
500V 20A N channel 0.27 ohm. 3 for $15

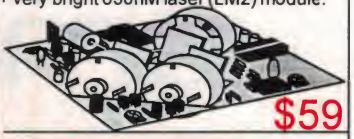
Series I, 3,4 CHANNEL UHF RECEIVER: Ref: EA Mar 94. Control up to 4 output relays. Uses a pre-built and pre-aligned UHF (304MHz) receiver module & security coding ICs. Output relays have 5A contact ratings and can be configured for toggling operation at each press of a Tx button or momentary operation when Tx button is pressed. 1 X 3ch transmitter plus 1 X4ch receiver:$50 extra Tx $15 is req. to access the fourth relay. 12V operation. (K39) $70

NICAD CHARGER & DISCHARGER:
Fully built & tested fast NICAD battery charger & discharger PCB. Has 6 ICs, 3 indicator LED's, 3 power MOSFETS, a toroidal inductor & more. Nominal unreg. input 13.7V DC, 900mA charge current. Appears to use volt slope to end charge, and timer to end charge. We supply a thermistor for temp sensing. Probably for fast-charging 7.2V AA nicads. 3 trimpots for adjustment + Basic info. $9 or 3 for $21

NEW DESIGN 110W CFL INVERTER KIT
The new improved design uses a larger transformer & a SG3525 switch mode Chip This very Efficient Driver kit can drive up to 11 X 10w CFL's from 12vdc. Great for lighting the week-ender or caravan Kit inc. 1 inverter & 1 CFL: $30 Extra CFLs $12

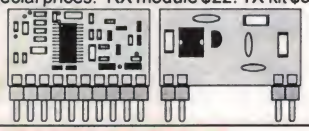
TELESCOPE Build your own,
with our high quality components: 1 X eyepiece lens worth $5 + 1 X prism worth $12.50 + 1 X large object lens worth $27 + plans all for the price of just $35

NEW SUPER LOW PRICE + LASER AUTOMATIC LASER LIGHT SHOW KIT: MKIII. Automatically changes every 5 - 60 secs, & is adjustable. Each motor has 8 speeds, one motor is reversible, & one can stop. Countless great displays from single to multiple flowers, collapsing circles, rotating single and multiple ellipses, stars, etc. Easy mirror alignment with "Allen Key". Kit inc. PCB, all on board components, three small DC motors, mirrors, precision adjustable mirror mounts: (K115) + very bright 650nM laser (LM2) module.



$59

UHF DATA TRANSMISSION
Stamp sized Xtal locked 433.9MHz superhetrodyne receiver module. Small matching transmitter kit:(K122) All at special prices. RX module $22. TX kit $8



OVERSPEED MONITOR KIT
Ref EA Feb. 97.Gives a signal when preset speed is exceeded. 12Vdc. A small PCB is provided for a Hall Effect pick-up sensor. This is mounted near the drive shaft & connected to the main PCB by three wires. Kit inc. 2 PCBs & all on-board com-ponents, a small speaker, & two small powerful 'rare earth' magnets: $22

MEGGER METER / INSULATION TESTER For testing for insulation breakdown or moisture ingress etc. of cables or connectors etc. This kit will deliver a genuine 500Vdc in to a 1M ohm load!!! This means that unlike other cheap kits it performs to **AUSTRALIAN STANDARD AS-3000.** Kit inc. PCB, all on-board components, surplus meter move-ment plus instrument case for just $50

8 CHANNEL IR REMOTE CONTROL KIT: Uses a Magnavox remote control housing & 8 keys, & replace the existing Tx PCB with ours. The RX uses an IR RX module @ 38KHz. The output of this simply feeds the matching SM5032B decoding IC. There are 8 outputs, 2 toggling & 6 momentary. To convert the TTL outputs to drive a relay, use our (K65D) Dual Relay Kit below. Transmitter PCB: 89 x 30mm. Receiver PCB: 48 x 34mm:
Tx Kit (K65T) $20 Rx Kit: (K65R) $20

VOLUME CONTROL KIT: With the above Tx and Rx kits you can add a motorised pot. / volume control to anything (K65V) $16 This kit can also be purchased with the above two kits, an RCA & suitable Plugpack: (K65C) $55

DUAL RELAYS KIT: With the above Tx & Rx kits you can control 2 relays to be mom-entary or latching: (K65D) $8

Make every movie a blockbuster

Centre speaker

Di-pole rear speakers

Powered subwoofer

JMC001

Jamo®

Home Theatre is revolutionising how we enjoy movies and television in our home. The quality of the performance, however, is directly related to the quality of the loudspeakers you use. Movie producers go to great lengths to create the ultimate soundtrack but not all speakers are up to the task.

Jamo is Europe's largest and most innovative speaker manufacturer. With award winning models born from 27 years of product development, Jamo lets you turn your living room into a home cinema complex and experience the big screen sound the way it was meant to be heard.

WINNER * THE '96 - '97 SOUND AND Image AWARDS

Jamo's complete range of centre speakers, rear speakers, subwoofers and front speakers means there is sure to be a Home Theatre speaker system for you. So the next time you watch a movie, make it a blockbuster.

For a **free** information kit and the location of your nearest Jamo Surround Sound demonstration centre, please call **Jamo Australia** on **(03) 9543 1522** or e-mail us on **info@jamo.com.au**
Web Page: **http://www.jamospeakers.com**

**Jamo SW-400e Subwoofer of the Year. Up to $999.*

A typical Home Theatre layout.

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